Bridge Rating & Analysis of
Structural Systems

BRASS - GIRDER™

Version 5

User Manual
February 2003

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Disclaimer

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AASHTO Specifications

The Ultimate Strength Analysis (LFD) portions of BRASS-GIRDER is current with the AASHTO *Standard Specifications for Highway Bridges*, Sixteenth Edition, 1996, with 1997, 1998, 1999, and 2000 Interims, and the AASHTO *Manual for Condition Evaluation of Bridges*, 1994, with 1995, 1996, and 1998 Interims. The steel girder splice component of BRASS-GIRDER is current with the AASHTO *Standard Specifications for Highway Bridges* with 1997 and 1998 Interims. There were numerous changes for splice analysis in the 1999 Interims and these changes **have not** been incorporated in BRASS-GIRDER. The standalone version, BRASS-SPLICE, has been updated to the 1999 and 2000 interims.

Only essential error correction has been performed on the Working Stress sections of the code. Working Stress resistance and ratings were held at the AASHTO 1983 Specifications through 1989 Interims and the AASHTO *Manual for Maintenance Inspection of Bridges*, 1983 (allowable operating stress for concrete shear uses the AASHTO *Manual for Maintenance Inspection of Bridges*, 1978) . This is a management decision made in order to focus limited resources on LFD and LRFD methods.

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When requesting Technical Assistance, please mail (or E-Mail) your input data set and mail (or FAX) a description of the problem, any error messages, any bridge drawings, and any hand computations which illustrates the concern. See page 2.12 for solutions to common errors.

Installing BRASS-GIRDER™

The setup programs for all the BRASS™ programs are loaded on a single CD-ROM. Passwords are required to install each program.

Listed below are the necessary system requirements to install BRASS-GIRDER™ on your computer's hard drive. It is permissible but not desirable to load BRASS™ on a network.

System Requirements

Operating System:	Microsoft Windows™ 95, 98, NT, 2000, Me, or XP
Microprocessor:	Pentium class or higher
Memory:	16 MB required, more is better
Hard Disk Space:	Approximately 8 MB
Virtual Memory:	Maximum of approximately 140 MB
Disk Drive:	CD-ROM drive

Installing BRASS-GIRDER

The following procedure describes how to install BRASS-GIRDER™. This method may also be used for installation onto a network drive.

1. Start Windows. Windows NT users may need to log in as **ADMINISTRATOR.**

2. If you have installed this program before and have modified the library files (i.e. sections.lby, truck.lby, etc.), back up these files. They will be over written during installation.

3. Close all applications.

4. Insert the BRASS CD.

5. Select the Windows **Start** button, then select **Run**.

6. In the Run dialog box, do one of the following:

- Type the letter of the drive containing the installation CD followed by a colon, the word *girder*, and the word *\setup*. For example, type **e:girder\setup.**

OR

- Select the **Browse** button, navigate to the directory named **Girder** on the CD, and select **setup.exe**.

7. Choose the *OK* button and follow the instructions on the screen. Setup does the following:

- Asks you to close any open applications.
- Prompts you to supply the directory path where the program files will be installed.
- Prompts you to supply a program folder name in the Windows Start>Programs menu.

Once the files have been installed, some file property modifications might have to be made. The following steps are not required if the program was installed in the default directory.

1. Open Windows Explorer and select the directory where the BRASS-GIRDER program files are located. The default location is C:\BGIRDER\EXE. If you install BRASS- GIRDER in a drive other than C:, you must create a directory C:\BGIRDER\EXE. Though this directory is not used by the program, it must exist on the C: drive.

2. Highlight the file **Girder.pif** (it may appear in Explorer as only **Girder** with a MSDOS icon on the left).

3. Select **File>Properties** or click the right mouse button and select **Properties.** The Properties dialog will appear.

4. Select the **Program** tab.

5. Edit the **Cmd line.** Type the BRASS-GIRDER executable file name.

   1. C:\BGIRDER\EXE\BRASSWIN.EXE

6. Next edit **Working**. Type the path to the working directory containing data files.

   2. C:\BGIRDER\EXE

7. Click the *OK* button for the changes to be saved.

8. Highlight the file **Util.pif** (it may appear in Explorer as only **Util** with a MSDOS icon on the left).

9. Repeat items 3-7 to modify the directories for this shortcut. On step 5, type the BRASS-GIRDER library utility executable filename. C:\BGIRDER\EXE\UTILWIN.EXE

If you have installed this program before, your library files were over written during installation. If your library files were over written, replace the installed library files with your backups.

It is possible for the environment space allocated for environment variables may be exceeded. If so, a DOS message will appear to indicate this. To increase the environment space, use the "SHELL" command in 'C:\CONFIG.SYS'. Add or modify the following line:

'SHELL=C:\COMMAND.COM\e:xxxx\p'

where xxxx is the amount of memory you wish to allocate. See DOS documentation for details. Reboot your PC after altering CONFIG.SYS.

How To Use this Manual

The first sections of this manual are designed to act as a self help guide for the novice user and as a reference guide for the more experienced user.

To the Novice:

Recommended reading is the Introduction, (Section 1), General, (Section 2), and then a brief look through Section 4, Typical Command Sets. Next, thirty minutes or more reviewing the rest of the manual section by section is recommended to get an idea of the types of commands available for defining a problem. There are sets of commands related to logical units of a bridge such as deck, spans, cross sections, physical properties, cable positions, dead loads, live loads, standard shapes and standard truck files.

One or two commands should be studied in detail noting the format of the command description and the structure of the command and following parameters. Each problem in BRASS is made up of a set of commands and associated parameters.

The next step recommended for the novice is to pick out a set of plans for a very simple bridge and code a set of commands. A structure should be chosen which closely matches one of the Typical Command Sets. The description of the Section in which the command resides should be read carefully. These descriptions are on the first pages of each tabbed Section.

If the above procedure is followed, the novice should be able to assemble a proper input data set (Command File). If the Command set does not work, contact your BRASS Advisor.

To the User of Previous BRASS Versions:

BRASS-GIRDER™ input is based on commands followed by up to twelve parameters. The parameters can be integer or floating point (contain a decimal) and need only be separated by a comma, column location does not matter so the input is “free format”. Each command has a three letter abbreviation. Several of the examples should be studied to get an idea of how the command structure language appears.

We also suggest you read “To the Novice” preceding this and follow the procedures as necessary.

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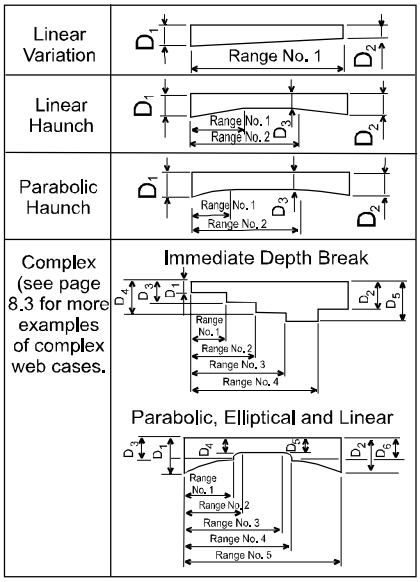
1. INTRODUCTION

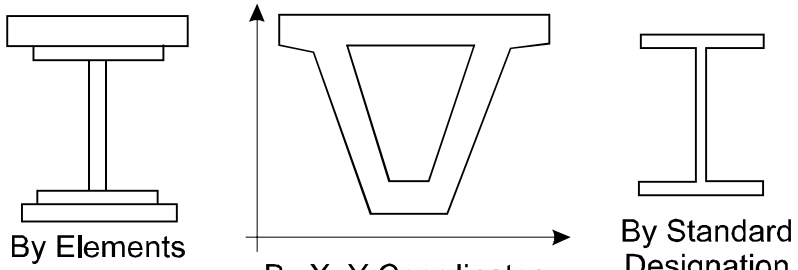
Bridge Rating and Analysis of Structural Systems

BRASS-GIRDER™ assists the bridge engineer in the design and load capacity determination of highway bridges. BRASS-GIRDER™ utilizes finite element theory of analysis and current AASHTO specifications. The system computes moments, shears, axial forces, deflections, and rotations caused by dead loads, live loads, settlements and temperature change. These actions are utilized by various subroutines to design or rate user-specified sections of the deck or girder.

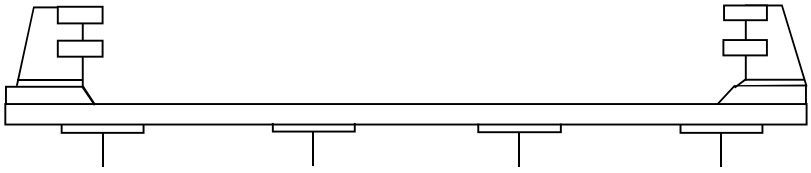
BRIDGE CONFIGURATION may be specified by limits of typical web depth variations (Fig. 1), girder cross sections (Fig. 2) and bridge deck cross section (Fig. 3).



Web Depth Variations
"D" in Inches - Range in Feet
Figure 1



Girder Cross Sections
Figure 2



Deck Cross Section
Figure 3

STAGE CONSTRUCTION may be modeled by respective cycles of the system for girder configuration and load application. Cycles are automatic if desired.

GIRDER TYPES may be simple span, continuous, hinged, or cantilevered with integral legs and constructed of steel, timber, reinforced concrete or prestressed concrete. Composite steel and composite prestressed girders may be included.

DEAD LOAD of structure members is automatically calculated if desired. Additional distributed loads and point loads may be applied in groups and each group assigned to a specific construction stage. Distributed loads may be uniform or tapered and divided into sections to model sequential slab pours. Loads due to prestressing are calculated and applied internally.

LIVE LOADS may be moving trucks including AASHTO HS type trucks or AASHTO lane type loadings. A truck may have up to 24 axles. Up to ten trucks may be analyzed in one run. Impact may be user defined as specified by AASHTO or the user may reduce impact to model reduced speed limits. Concurrent actions and interactions are produced.

DESIGN functions are included for (1) reinforcing steel in concrete decks or girders using working stress analysis. Results include bar cutoff lengths, stirrup size and spacing, (2) stiffener design on steel girders, (3) splice plate and fastener details, and (4) prestressed concrete girders.

RATINGS of the maximum load carrying capacity may be determined in one run for four different stress levels: inventory, operating, posting and safe load capacity.

PRESTRESSED GIRDER FEATURES

- Simple span for dead load, continuous span for live load.
- Straight, harped or parabolic cable paths.
- Secondary moments due to creep and shrinkage are accounted for.
- Stress relaxation of steel strand is accounted for as a function of time.
- Effects of temperature change can be analyzed at any stage.
- Support conditions can change from stage to stage.
- Results of individual loads may be obtained.
- Composite girders may be analyzed.

GENERATORS for the mesh of links and nodes for finite element analysis and girder properties keep user input to a minimum. User defined libraries for standard girder shapes and trucks also reduce input requirements.

BRASS INPUT LANGUAGE allows the bridge engineer to communicate with the problem-solving capabilities of BRASS using terminology common to the bridge engineering profession. System input is free format consisting of commands grouped logically to define the bridge structure, loads to be applied and the output desired. Figure 4 shows the command groups.

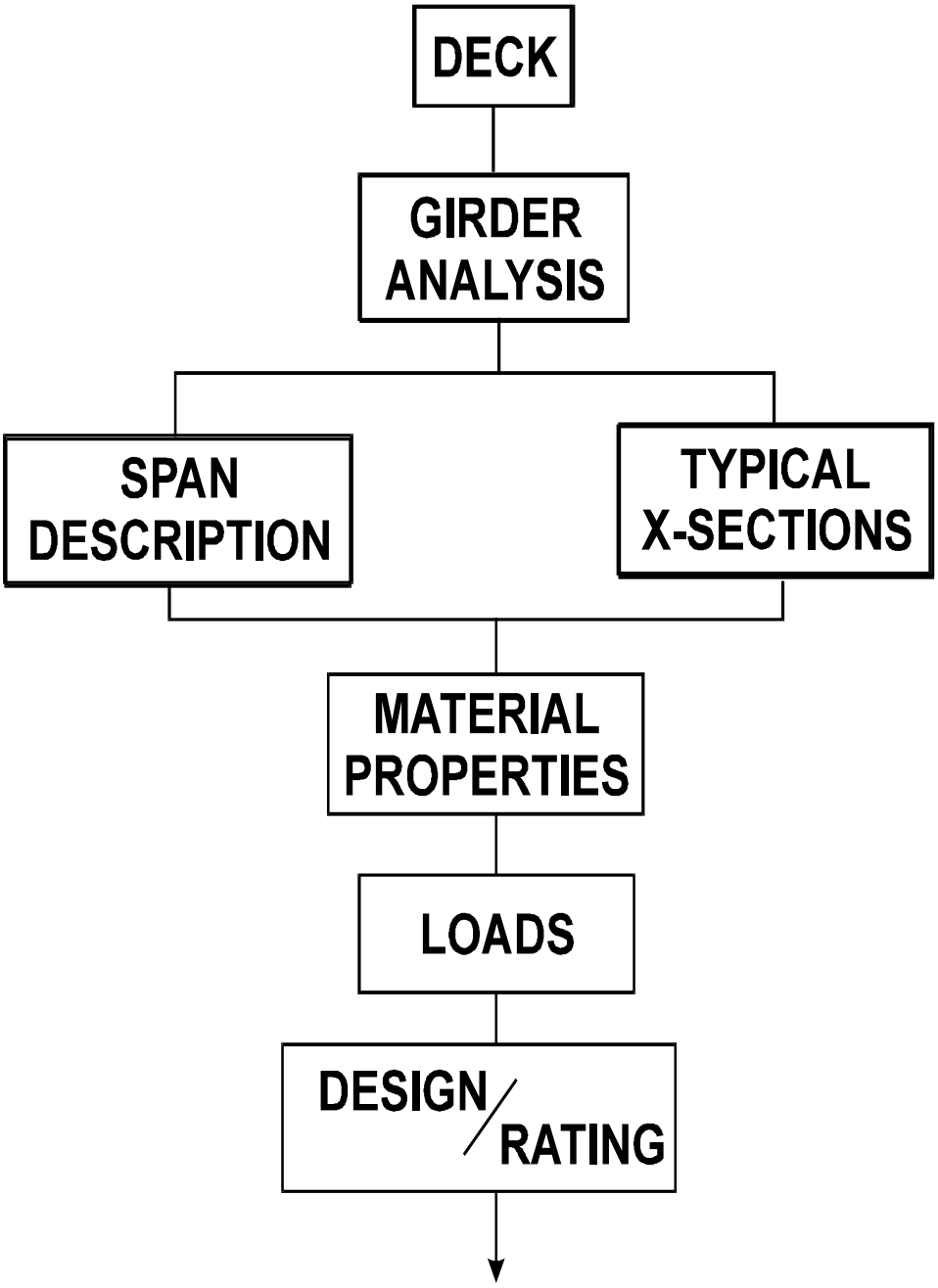


Figure 4 Command Groups

OUTPUT -- data is logically arranged and self-explanatory. The amount of detail is controlled by the user.

LANGUAGE -- used in BRASS-GIRDER™ is FORTRAN 90.

The BRASS Family

BRASS is a family of programs that assists the engineer in many aspects of bridge design and rating. These programs are described below:

BRASS-GIRDER(LRFD)™ -- A comprehensive system for the design and/or rating of highway bridges decks and girders using finite element theory of analysis and current AASHTO LRFD Specifications.

BRASS-PIER™ -- Performs an analysis of a bridge transverse section at pier locations. The program provides a comprehensive analysis of bridge decks, piers, and selected foundation types. All AASHTO loads and group loads are considered. Live load is automatically positioned for maximum actions. Load factor and working stress computations are performed.

BRASS-PIER(LRFD)™ -- Performs analysis of a bridge transverse section at pier locations. Provides a comprehensive analysis of bridge decks, piers, and selected foundation types. All AASHTO (LRFD) loads and group loads are considered. Live load is automatically positioned for maximum actions.

BRASS-TRUSS™ -- Performs a comprehensive working stress analysis and rating of simple or continuous truss or girder floorbeam stringer type bridges.

BRASS-CULVERT™ -- Performs analysis or design of one, two, three, or four barrel reinforced concrete rigid or flexible box culverts, with or without bottom slab. End skews can also be defined. Wall and slab thickness may be specified or the program will set the thickness. AASHTO guidelines are followed and Service Load Design, Load Factor Design, or Load and Resistance Factor Design may be specified. Member capacities are designed based on applied truck load, soil fill, self weight and water pressure. Standard AASHTO and user defined truck loadings can be specified. Output generated by the program includes: culvert geometry; moments, shears, and axial forces at tenth points; stresses; required area of reinforcement; steel design table; splice length; weights and volumes of steel and concrete; and influence ordinates. Critical design moments, shears, and axial forces for each member are summarized. Flexural rating computations may be optionally computed.

BRASS-SPLICE™ -- Performs the design of field splices for rolled beam or welded plate steel girders. Design criteria are in compliance with the AASHTO Standard Specifications and WYDOT design practice. Load factor and working stress computations are performed.

BRASS-PAD™ -- Performs the load factor design of bridge bearings constructed partially or wholly from elastomer, the purpose of which is to transmit loads and accommodate movements between a bridge and its supporting structure. It designs plain pads (consisting of elastomer only) and reinforced bearings (consisting of layers of elastomer restrained at their interfaces by integrally bonded steel plates or fabric).

BRASS-POLE™ -- Performs a working stress analysis of cantilever sign, luminaire and signal support structures. Round or polygonal steel poles may be analyzed according to the AASHTO Standard Specifications.

BRASS-DIST™ -- Performs a finite-strip element analysis to determine the factor for wheel load distribution for any axle spacing or width and any tire configuration of a truck placed at any position on the bridge deck. Standard trucks may also be used. NOTE: AASHTO formulas are based on empirical data and are applicable to six foot axle widths. BRASS-DIST™ will also give results for a simple beam "deck-to-girder" analysis for dead loads.

2. GENERAL

BRASS-GIRDER™ is designed to assist a bridge engineer in the design or rating of a bridge deck or girder. See page 2.2 for the types of bridges for which BRASS is applicable.

To use BRASS-GIRDER™, the engineer inputs a series of "Commands" each followed by one or more parameters. The engineer describes: 1) the bridge deck, 2) the typical girder cross sections with their beginning and ending points along the girder, 3) the girder geometry such as span lengths, leg angles, etc., 4) the material properties, 5) applied dead and live loads, and 6) the allowable stresses to be used.

"Typical Command Sets" are provided to help the engineer become acquainted with the system. These begin on page 4.1.

BRASS-GIRDER™ uses numerous default values. If a Command parameter has a default value listed, the parameter may be left blank and the default value will be used. Be sure to enter zero if it is a valid value.

Short descriptions of the Commands and their parameters are summarized in the BRASS-GIRDER™ Command Language Manual. If additional information is required, each short description of a command has the number reference for the full description.

Each input data set or Command File must begin with one or two TITLE commands. Optional COMMENT commands may be used as often as needed to document the input series of commands.

BRASS follows a specific command order for the problem description:

1) Title
2) Bridge Deck
3) Typical girder cross sections
4) Bridge span data
   - length
   - web depth variation
   - typical cross-section limits
   - cable path geometry
   - end restraints
   - hinges
5) Material properties
6) Dead & live loads
7) Allowable stresses

The manual is arranged in the same order as above and an overview precedes each group of commands which is tabbed for quick reference. Additional overviews on prestress girders, composite steel and concrete girders, bridge decks, composite steel and concrete girders, prestressed concrete girders and ultimate strength concrete design are found on pages 7.1, 8.1 through 8.5, 12.1, 14.48 and 14.49.

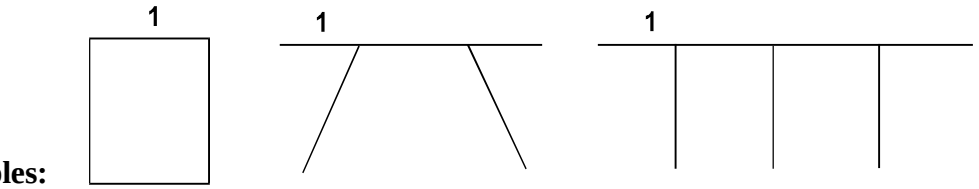
The analysis method utilized in BRASS-GIRDER™ for bridge decks is moment distribution. For girder analysis, the girder is discretized into nonprismatic beam elements and the finite element method is applied.

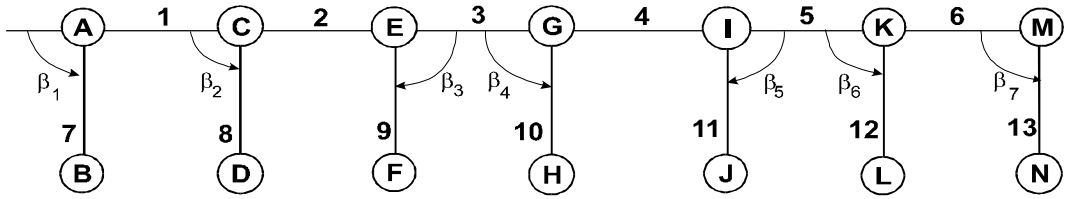
Bridge Types

- Continuity
  Simple or continuous spans (up to 13 maximum).

- Framed Joints
  Two dimensional framed joints are allowed as long as the structure is some variation of the figure below and span 1 is included.

Examples:





- Joint Restraint
  All joints may be restrained for horizontal or vertical translation and/or rotation.

- Hinges
  A maximum of two hinges is allowed per span.

- Cantilevers
  Cantilevered spans or portions of spans are allowed.

- Settlement
  Known joint displacements may be imposed and the resulting actions determined.

- Temperature
  The structure may be subjected to a given T and the resulting actions determined.

- Bridge Decks
  Timber (plank or laminated) or reinforced concrete bridge decks may be analyzed.

- Main Members (Service Load Design Method or Strength Design Method)
  Reinforced concrete
  Prestressed concrete
  Steel welded plate
  Rolled steel wide flange or I-beams
  Composite steel and concrete
  Timber (Service Load Design Method Only)

Input Format

The commands guide the user in building an ASCII data file. This data file is developed in a command format. Each line begins with a command which describes data entries hereinafter referred to as parameters. A blank space following the command *is required*.

The data may be entered as a real (including a decimal), an exponential (i.e. 12.345e4), an integer (excluding a decimal point) or an alpha character. Zero is not the same as a blank. Alpha characters are NOT case sensitive. Default entries are given with most commands and are employed by a blank field or by omission of the command in those cases where all default values are desired. Each command has a three character abbreviation which may be used in lieu of the full command name. Commands and their abbreviations are also NOT case sensitive.

Commas are used to delineate parameters. The number of spaces between entries has no meaning, however, do not use tabs to separate entries. For example, if the third entry of a command is the only entry required, any of the following would be valid.

```
COMMAND-EXAMPLE     ,     ,     2.0,    ,     ,
COMMAND-EXAMPLE     ,     ,     2
CEX           ,     ,     2.0
CEX           ,           ,           2.0000
CEX           ,     ,     2
```

Continuation Character: A maximum of 80 characters is allowed per line in the data file. Some commands have numerous parameters and all of them may not fit on one line. Therefore, a continuation character may be used to indicate that another line follows which should be appended to the command line. A slash (/) is used as the continuation character and must be the last character in the input line. There is no limit on the number of continuation lines, however, the total number of characters for one command is 160. An example continuation is illustrated.

```
COMMAND-EXAMPLE  123.4, 567.8, 901.2, 345.6, 789.0, 123.4, 567.8, /
                 901.2, 345.6
```

It is not required to build an input data set and run BRASS from Windows™. The user may use any ASCII text editor to create an ASCII data file. BRASS-GIRDER™ may be executed at the DOS prompt by entering 'C:\BGIRDER\EXE> BRASS filename.DAT filename.OUT".

Route Option

Often, a Bridge Rating Engineer must run all the bridges along a particular route to obtain load ratings for an overload vehicle. Effective use of the ROUTE option and the INCLUDE command will eliminate the need to manually change the truck configuration in every input data set whenever a new overload vehicle is routed through the state.

First, create a file (i.e. LLOADS.DAT) containing only the appropriate truck command(s) which describe the overload vehicle:

```
TRUCK-1    QUARRY1,QUARRY2
```

Next, replace the truck command(s) in every data set with the INCLUDE command:

```
INCLUDE C:\BGIRDER\EXE\LLOADS.DAT
```

In this manner, the user only need to change one file (LLOADS.DAT) whenever new loads are to be analyzed.

Third, create a second file called BRIDGES.DAT (or whatever) which contains a list of all input data sets along the route to be analyzed.

```
AAA.DAT
AAC.DAT
AAD.DAT
AAE.DAT
AAF.DAT
AAG.DAT
AAH.DAT
AAI.DAT
AAJ.DAT
AAK.DAT
AAL.DAT
AAM.DAT
AAN.DAT
```

This file can be created by hand, a database query, or Geographical Information System routing program.

Finally, to run the entire set of bridges, enter:

C:\BGIRDER\EXE> BRASS BRIDGES.DAT BRIDGES.OUT ROUTE KEEP

- or -

C:\BGIRDER\EXE> BRASS BRIDGES.DAT BRIDGES.OUT ROUTE DELETE

The 'KEEP' option will save the entire output file for each bridge. The 'DELETE' option will not save individual output files. In both cases, a summary file will be created (BRIDGES.OUT) which gathers all the rating information in a single file and a status file (filename.STS) is created to record whether a particular data set is executed properly. If 'KEEP' or 'DELETE' is omitted, the default is 'DELETE'. **NOTE**: The ROUTE option is a DOS command and is not available in the Graphical User Interface.

Microsoft Windows™ Graphical User Interface

Introduction

A Microsoft Windows™ based Graphical User Interface has been developed to take advantage of many of the features within the Windows™ environment. These features include user friendly graphical input forms (also called 'dialog boxes'), on-line help, 'point-and-shoot' text editors, and drop down menu commands. This section is designed to help you get started with using the BRASS-GIRDER™ Graphical User Interface (GUI).

Running the Graphical User Interface (GUI)

To enter the GUI, double-click on the application icon 'BRASS GIRDER' in the BRASS Program Group.

Most of the BRASS dialog boxes have standard Windows functions. Dialog boxes created specifically for BRASS-GIRDER™ each have five additional buttons:

This button will write the data entered in the dialog box into the input data set. It will then close the dialog box and move on to the next command.

This button will cancel the entries into the dialog box and will close the box.

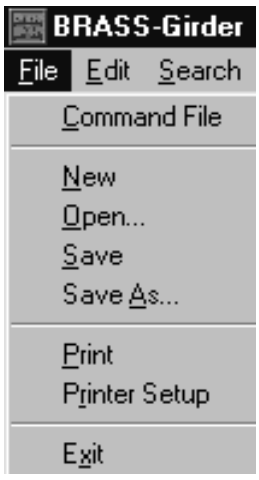
This button will write the data to the input data set and leaves the dialog box open. This function is useful when a particular command is to be repeated several times with minor changes to the data (i.e. several rows of reinforcing with minor changes in row location).

If another line of the same command is desired (i.e., TLE or DBA), this button will "Refresh" or clear the previous input and reset variables to their default values.

This button will access the *help* file for the displayed dialog box.

NOTE: If two or more of the same commands are desired, do not use *Write* button for the final entry. Use the *OK* button. If you use *Write* and then *OK*, it will duplicate the last set of data. If you inadvertently click the *Write* button, you may double click the negative symbol in the upper left hand corner or the smallest window displayed to exit properly. This writes the values to the input file and exits the dialog box. In short *OK* performs *Write* and then *Cancel* in that order.

Description of the File Option:



COMMAND FILE: This will open the last command file (input data set) you were working on in this session, or will open a blank input data set named 'input.pol'.

New: Open a new command file.

Open: Open a specific command file.

Save: Save the current command file.

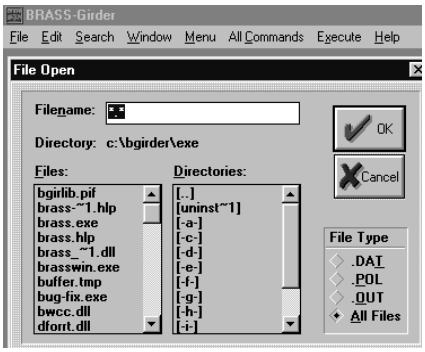
Save As: Save current command file in the directory and name you specify.

Print: Print current command file.

Printer Setup: Open the windows printer setup to specify a printer.

Exit: Exit BRASS-GIRDER™.

The Open option will display a dialog box that is slightly different than the standard **Open** box found in most Windows™ applications.



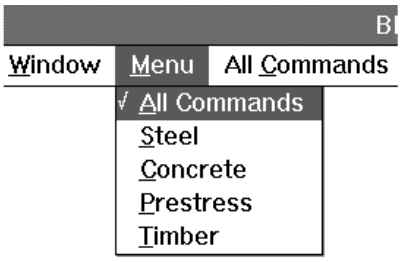
You may select any of the 'filter' options by clicking any of the *File Type* check boxes in the lower right hand corner.

Creating a BRASS-GIRDER™ Command File (Input Data Set):

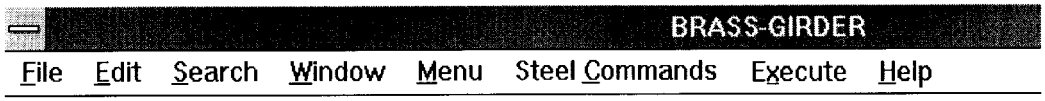
Remember, the Windows™ Graphical User Interface (GUI) is just a *tool* for creating an ASCII input data set. On-line help, program execution, and library maintenance are also available in the GUI, however, it is not required to use Windows™ to perform these functions.

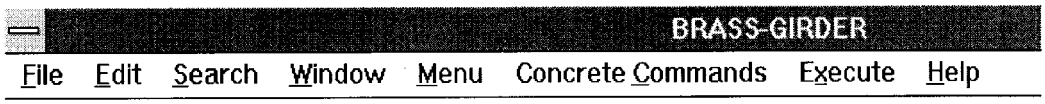
In the GUI, the user may create an input data set using any combination of the following three methods: 1) By selecting **File**, then **New**, the user is placed in DOS 5.0+ EDIT. Commands may be typed following the same format and procedures as outlined in the BRASS-GIRDER™ manual; 2) While in EDIT, the user may select the **All Commands** drop down menu then select any of the available dialog input forms to create commands; 3) The **Path Generator** (in the **All Commands** drop down menu) may be used to automatically select dialog input forms. The last method will be described in more detail later.

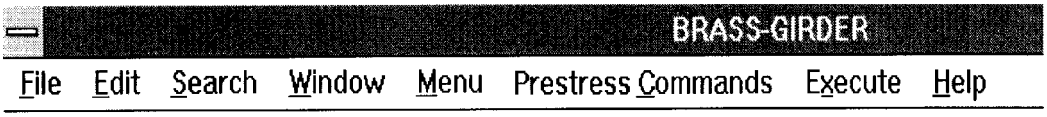
Description of the Menu Option:

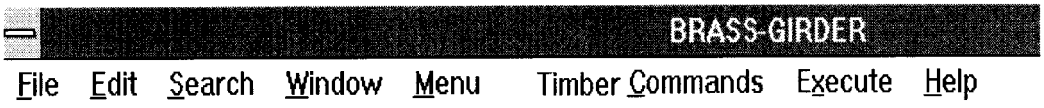


Dialog boxes have been developed to describe the majority of steel, concrete, prestressed concrete, and timber bridges. Some dialog boxes are general in nature and can be used to describe any type of bridge. Other dialog boxes pertain to a specific type of bridge (i.e. steel). The user can control the types of dialog boxes to be displayed using the **Menu** option. Sub-option **All Commands** will permit the user to use any dialog box, regardless of bridge type. The other sub-options will modify the menu bar and permit the user to select only those dialog boxes which pertain to a specific bridge type.

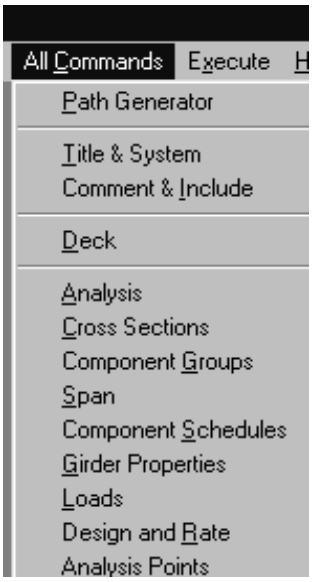




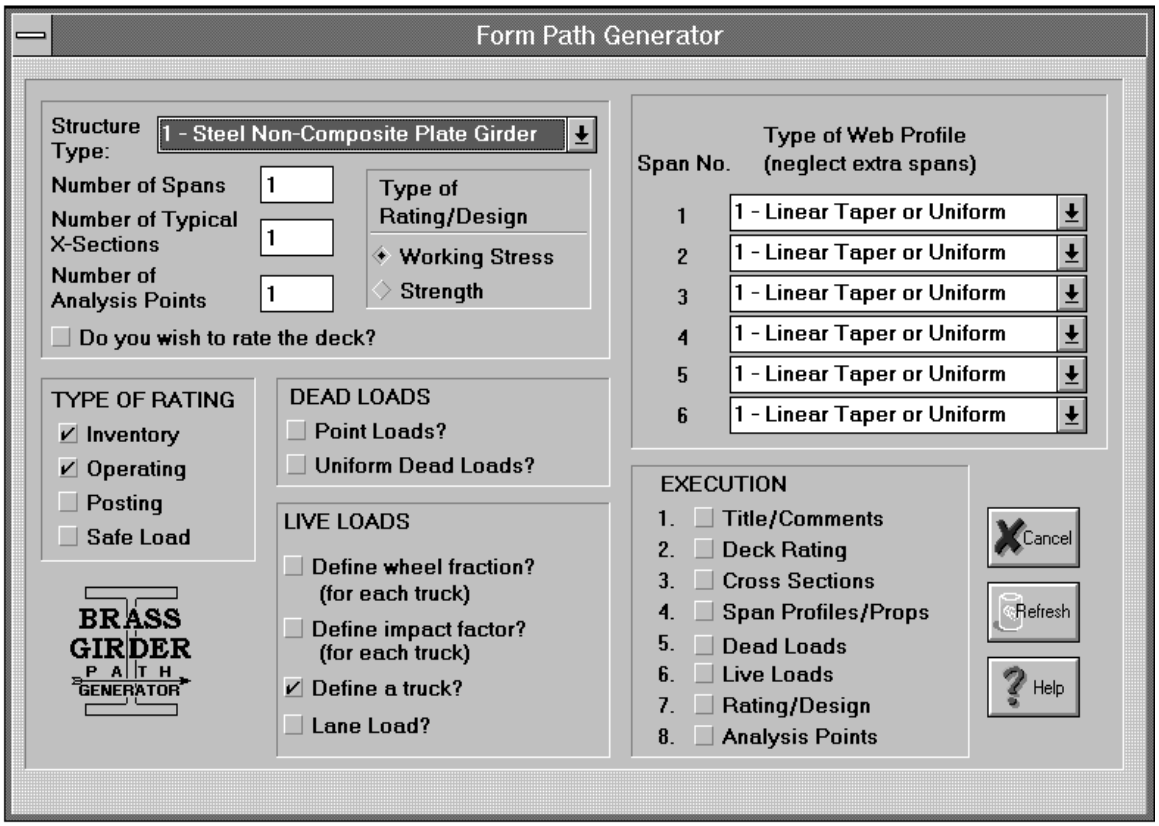




Once the user has selected the appropriate menu bar, the dialog boxes from **Title & System** through **Analysis Points** may be displayed.



NOTE: BRASS-GIRDER™ commands must be placed in the order they appear on this list and in the User Manual.



The Path Generator is an optional tool which prompts the user to define the type of structure to be analyzed. From this information, it provides a series of dialog boxes required to describe the structure. Once the structure has been defined on the **Path Generator** dialog box, the user can proceed to generate the input file by checking each of the *EXECUTION* boxes in sequence. Each box, when checked, will display the dialog boxes required to describe the bridge.

Remember, the Path Generator displays *only* those forms that are required for the structure that has been defined. Additional data may be required for specific cases.

Structure Type - Select the type of girder material.

Number of Spans - Enter the number of spans in the bridge. The Path Generator can only generate dialog boxes for a maximum of six spans.

Number of Typical Cross Sections - Enter the number of unique cross sections in the bridge.
NOTE: Changes in web depth *only*, does not depict a separate cross-section. Web depth variations are described in the SPAN commands.

Number of Analysis - Analysis points are usually selected at the 1.0, 1.4, 2.5, *Points* etc. points for a 3-span bridge. Enter the number of locations to be analyzed.

Type of Rating/Design - Check if you want a Working Stress or Ultimate Strength (LFD) rating or design.

Type of Rating
- For a Working Stress analysis, check the type(s) of rating desired. For a concrete Load Factor Design analysis, check the type(s) of rating desired. **IMPORTANT:** For a steel Load Factor Design analysis, the commands *change* from INV, OPG, PST, and SLD to Load Level 1, Load Level 2, Load Level 3, and Load Level 4. **All** Load Levels are needed to determine steel LFD ratings. It is *strongly* recommended you read the NOTES on page 14.9 of the Users Manual.

Point Loads - Check if dead point loads are to be input.

Uniform Dead Loads - Check if uniform dead loads are to be input.

Define Wheel Fraction - Check if a user defined wheel fraction will be input for each truck.

Define Impact Factor - Check if a user defined impact factor will be input for each truck.

Define a Truck - Check if a truck from the Truck Library is to be analyzed, or if a unique truck configuration will be input.

Lane Load - Check if lane loads are to be analyzed.

Type of Web Profile - Select the type of web profile which exists in each span. See page 10.2 of the Users Manual for an explanation of each 'Web Profile'.

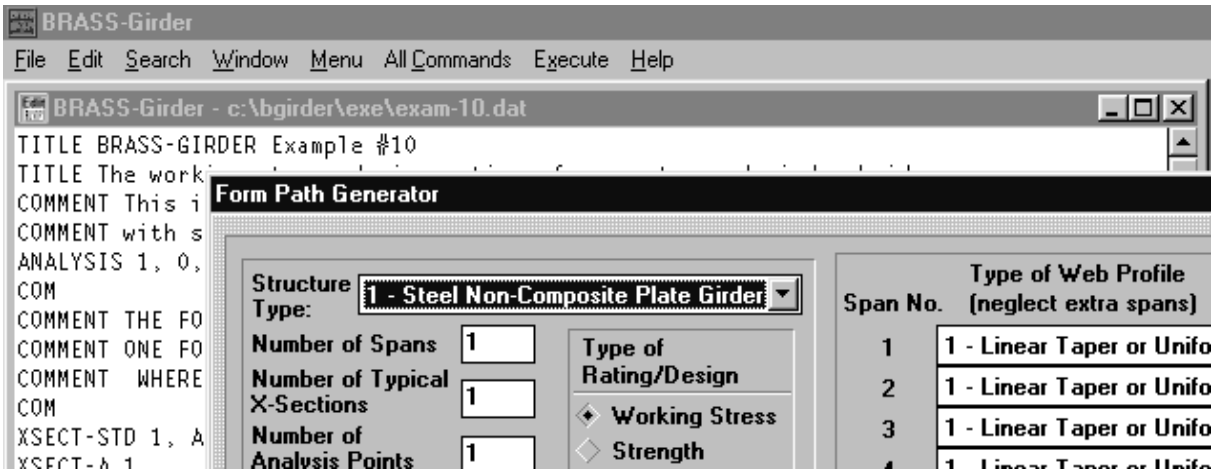
EXECUTION - As described above, check each box, in order, to display the required dialog boxes. The *Refresh* button will reset the structure definition fields but will not affect the *EXECUTION* check boxes.

If a file is created using the Path Generator, the user must be sure to carefully review the commands created. A helpful hint is to always note the commands indicated at the top of each dialog box that is displayed by the Path Generator.

Effective Use of the Command File:

Many GUI users prefer displaying the active Command File (or input data set) while entering data from the dialog boxes. This allows you to view the data *while* it is being added to the input data set.

You can view the input data set at any time by pulling down the **File** menu and selecting **Command File**. If you are working with the **Path Generator**, the input data set you are creating will be placed behind the **Path Generator** window.



To view the Command File, move the **Path Generator** window (or dialog box) to the side. This is done by clicking the mouse in the window title strip (at the top) and dragging the mouse (hold the left button down and move). Clicking anywhere in the **Command File** will bring the **Command File** to the front. Be sure to click anywhere in the **Path Generator** or dialog box to continue data input.

WARNING! As with most commands in BRASS, the commands may require placement in the file in a specific order (refer to the BRASS manuals). Using the **Commands** menu, as well as the **Path Generator**, will *place the command generated at the position of the cursor in the command file*. If you have just opened the file to edit, the cursor is automatically placed at the top of the input file. Before leaving the Command File to input data from a dialog box, ensure the cursor is placed at the **END** of the Command File or at the location you wish to enter data.

Individual commands may be inserted in a Command File at any time, in any place, from a dialog box.

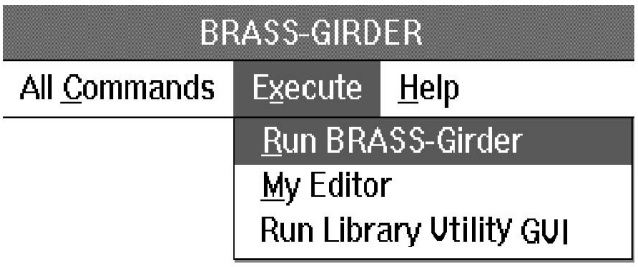
First, open the Command File and place the cursor at the location you wish to insert the command (usually before the first character of the following command). When the dialog box exits, the new command line will be inserted. **IMPORTANT:** Be sure to place the cursor in the first space below the last command before continuing to enter data from dialog boxes. As always, the Command File may be edited at any time using standard editor commands.

The Command File (input data set) must be saved and exited before executing BRASS-GIRDER™.

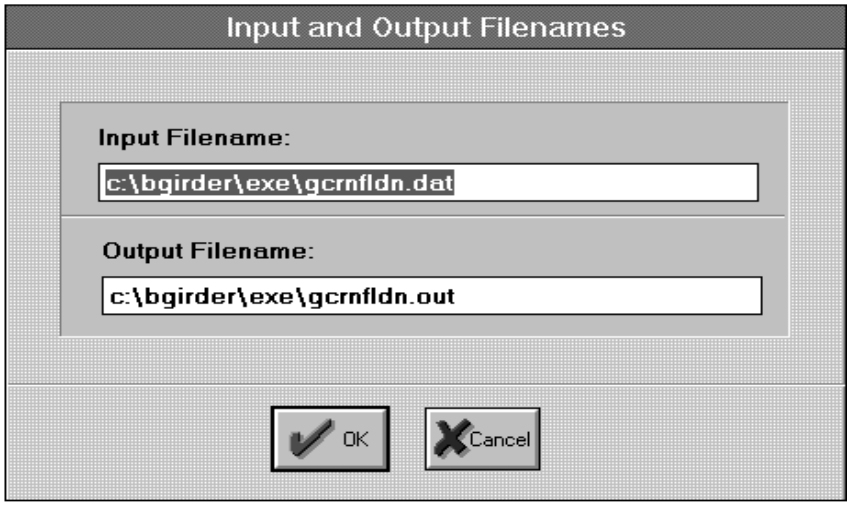
Executing BRASS-GIRDER™ from the Graphical User Interface:

To execute BRASS-GIRDER™, you must first open the Command File and then close it. This 'activates' the Command File and prepares it for execution. If you do not 'activate' the Command File, BRASS-GIRDER™ will execute the last Command File work that was performed on during the current session or it will execute the default file 'input.pol'.

Next, select **Execute** then **Run BRASS-GIRDER™**.



You will then be prompted for the input data set file name to run. The current 'activated' Command File will be placed in the *Input Filename* box and the *Output Filename* will be set to *filename.OUT*.



Selecting the *OK* button will begin executing BRASS-GIRDER™.

When BRASS-GIRDER™ begins execution, the screen will turn black and the status of the analysis will scroll by on the screen. Upon completion of the analysis, the BRASS-GIRDER™ GUI will reappear. To retain messages on the screen (in the case of input data set debugging), see section 'Bugs, Gremlins and Other Problems' below.

Running Library Maintenance:

A separate executable program is used to perform Library Maintenance such as adding, deleting, changing, and printing the contents of the truck library (TRUCK.LBY), and the standard shapes library (SECTIONS.LBY). It is best to create your data set in the Library Utility GUI. From the **Execute** menu item, select **Run Library Utility GUI.** Once the input data set is created, select **Execute>Run Library Maintenance**. Exit this GUI to return to the BRASS-GIRDER™ GUI.

Viewing BRASS Output Files

Output files may be viewed using most text editors or word processors. Unfortunately, edit control, used by the GUI, does not utilize enough extended memory to load large output files. Therefore, you cannot view/edit large output files from inside the Graphical User Interface. An alternate editor is required. Smaller files, such as input data sets, may be viewed within the BRASS-GIRDER™ GUI.

To alleviate this problem, there is a sub-option in the **Execute** drop down menu called **My Editor**. This sub-option allows you to use any text based editor (Norton Deskedit, Lancaster University's Programmer's File Editor) or any word processing program (Microsoft Word, Corel Word Perfect). To activate **My Editor**, add the following line to your AUTOEXEC.BAT file:

set BRASS_EDITOR=c:\wpwin60\wpwin.exe
(**Note:** "BRASS_EDITOR" **must** be upper case)

where the directory and executable shown above is selected by the user.

A shareware text editor called Programmer's File Editor, written by Alan Phillips, Lancaster University Computer Centre, United Kingdom, has been included with BRASS-GIRDER™. It must be noted that this program is a shareware program and is *not* an essential component of BRASS-GIRDER™. It is provided to the user, free of charge, as an optional text editor.

The output is formatted for portrait page orientation, with margin settings of 0.5" for the top, bottom, and left and 0.3" for the right.. A mono-spaced font, such as 8 pt. Courier New, is required for column alignment.

There are several commands available to the user to control the amount and type of output. These commands are located in:

Command #	Command	Page
#30	SYSTEM-1 command	6.2
#40	SYSTEM-2 command	6.6
#50	SYSTEM-3 command	6.8
#60	DECK-CON command, parameter 1	7.2
#310	ANALYSIS command, parameter 1	8.6
#460	SPAN-A command, parameter 7	10.5
#520	HINGE command, parameters 3 and 4	10.42
#823	TRANSFER command, parameters 2 to 19	12.30
#830	DEAD-LOAD command, parameter 1	13.2
#980	DESIGN command, parameter 1	14.2
#1030	STEEL-1 command, parameters 1 and 10	14.22
#1065	STEEL-5 command, parameter 9	14.37
#1080	CONCRETE-1 command, parameters 1 and 7	14.42
#1170	PRESTRESS-1 command, parameter 1 and 10	14.64
#1190	TIMBER command, parameter 1	14.84
#1240	PRINT-TRUCK command	15.14
#1340	PRINT-SECT command	15.36

Three additional output files (TABLE1.TBL, TABLE2.TBL, and TABLE3.TBL) are created when BRASS-GIRDER™ is executed. These files are used by the AASHTOWare Virtis™ program to insert results into a database.

Accessing Help

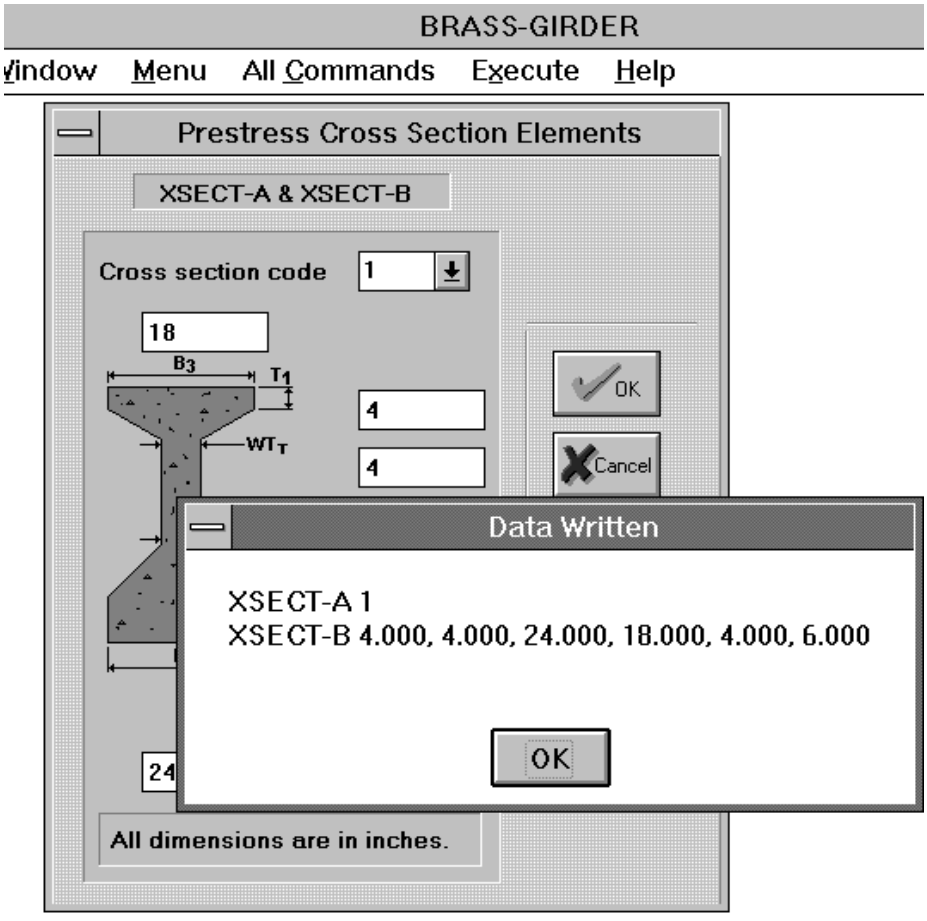
You can use the on-line Help system to view information about any BRASS-GIRDER™ command or dialog box. To access the complete Help file, choose the **Help** command from the Menu bar:

Clicking on any green text (hypertext) will place you in the Help section pertaining to that text. The Help file can also be accessed by pressing the *Help* button in any of the dialog boxes. Doing so will place you in the Help file pertaining to that particular command.

You can also obtain help for a particular command by placing the cursor on any line in the Command File and pressing the <Ctrl F1> keys simultaneously.

Refer to your Microsoft Windows™ documentation for directions using Help.

Some users requested immediate notification that data was being written to the Command File. The menu item **Help>Show Writes** will display a dialog box that shows the data that was written to the Command File when the *Write* button is selected:



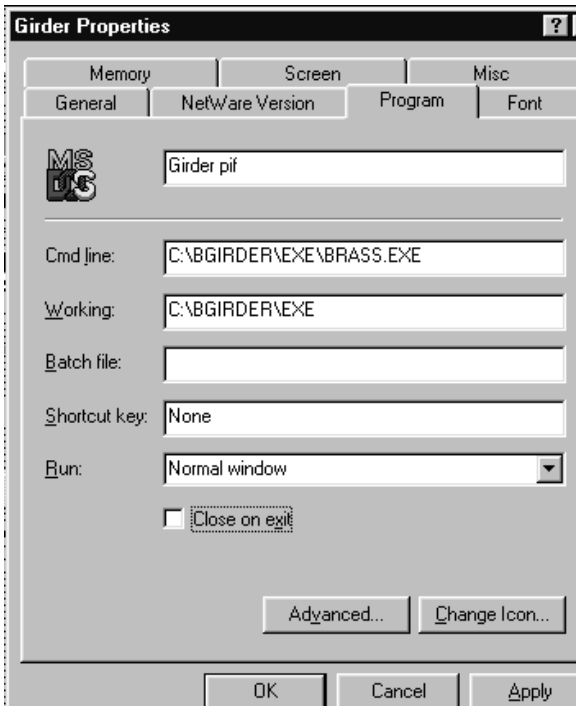
If you inadvertently activated the function, you can disable it by choosing **Help>Show Writes**. Disabling the function should remove the check mark in front of the words *Show Writes.*

Bugs, Gremlins and Other Problems

Inevitably, every user will have an input data set that will not run properly. Based on past experience, approximately 90% of all problem logs are user error. Naturally, this should be the first place to look when BRASS won't run. A lot of error and warning messages have been written into the source code to handle the most common errors. It is nearly impossible to anticipate every error which may occur. When searching for coding errors, check the output file and/or screen messages for clues to the problem.

Occasionally, error messages flash on screen too fast for reading. There are two methods to retain these messages on screen. First, run BRASS-GIRDER™ from the DOS prompt, as described on page 2.3.

Second, edit the GIRDER shortcut file. In Windows Explorer, locate the file C:\BGIRDER \EXE\Girder. Explorer will display the MS-DOS icon with this file. Right click on the file and select Properties. Select the Program tab. To display all error messages, make sure the box saying **Close on exit**, in the lower portion of the dialog box, is not checked.



Other common error messages are *Math Error* or *Divide by Zero Error*. This message usually indicates that some required data was not input. Check your input data set for omissions.

If you cannot resolve the problem, you can request technical assistance using the procedures listed on page i.

3. LIST OF COMMANDS FOR

JOB CONTROL:

AGENCY	AGY	1	User agency or company name.
BRIDGE-NAME	BRN	2	Structure number and feature intersected.
LOCATION	LOC	3	Reference marker location and route.
ENGINEER	ENG	4	Engineer who created input data set.
TITLE	TLE	10	Problem Title
COMMENT	COM	20	Input Comments
INCLUDE	INC	25	Reads an include file.
END	END	28	Separates multiple input data sets within a single Command File.
SYSTEM-1	SY1	30	System Control No. 1.
SYSTEM-2	SY2	40	System Control No. 2. Primarily a debugging aide by component.
SYSTEM-3	SY3	50	System Control No. 3. Primarily a debugging aide by subroutine No.

BRIDGE DECK:

DECK-CON	DCN	60	Bridge Deck Control
DIST-CONTROL-DL	DCD	65	Bridge Deck Dead Load Distribution Control
DECKC-STG	DSG	70	Stage construction control
DECKC-COM	DCM	80	Dead loads to be combined for concrete deck strength analysis.
DECKC-MAT	DMT	90	Concrete deck material factors for design or rating of concrete deck.
DECKC-STR1	DS1	100	Allowable stresses. Required for design or rating of concrete deck.
DECKC-STR2	DS2	110	Allowable stresses. Required for rating of concrete deck if posting and/or safe load capacity rating desired.
DECKC-STR3	DS3	115	Value of Phi. Required for rating of concrete deck unless default values are used.

DECKC-DIM1	DD1	120	General dimensions. Required for concrete.
DECKC-DIM2	DD2	130	General dimensions. Required for concrete curbs and/or median.
DECKC-DIM3	DD3	140	General dimensions. Required for concrete.
DECKC-DIM4	DD4	150	General dimensions. Required for concrete tapers.
DECKC-DIM5	DD5	160	General dimensions. Not required for concrete tapers if no tapers or identical cantilevers.
DECKC-GS	DGS	170	Variable girder spacing. Required for concrete if spacing varies.
DECKC-BARA	DBA	180	Repeat for each rebar in 1' width of deck.
DECKC-LODG	DLG	190	Deck dead loads. General information.
DECKC-LODC	DLC	200	Concentrated Dead Loads. Required for concentrated loads on concrete deck. Repeat as needed.
DECKC-LODU	DLU	210	Uniform dead loads. Required for uniform dead loads on concrete deck. Repeat as needed.
DECKT-G1	DG1	220	General data for timber deck.
DECKT-G2	DG2	230	General data for timber deck.
DECKT-G3	DG3	240	General data for timber deck.
DECKT-LWT1	DL1	250	Wheel load contact. Area dimensions for timber deck.
DECKT-LWT2	DL2	260	Wheel load contact. Area dimensions for timber deck.
DECKT-LWT3	DL3	270	Wheel load contact. Area dimensions for timber deck.
DECKT-LWT4	DL4	280	Wheel load contact. Area dimensions for timber deck.
DECK-TRK1	DT1	290	Live load. Required for design or rating.
DECK-TRK2	DT2	300	Live load. Required for design or rating if more than 6 trucks to be rated or default for impact to be overridden.

STRUCTURE ANALYSIS:

ANALYSIS	ANL	310	General Data
ANGLE-1	AN1	320	Leg angles

ANGLE-2	AN2	330	Leg angles

TYPICAL CROSS SECTIONS:

XSECT-STD	XST	340	X-section properties. Required for standard cross sections called from standard sections file.
XSECT-A	XSA	350	X-section properties No. 1. This series required for each unique non-circular, non-standard or non-x-y coordinate defined x-section.
XSECT-B	XSB	360	Cross section properties No. 2.
XSECT-C	XSC	370	Cross section properties No. 3.
XSECT-D	XSD	380	Cross section properties No. 4.
XSECT-E	XSE	390	Cross section properties No. 5.
XSECT-F	XSF	400	Cross section properties No. 6.
XSECT-G	XSG	410	Cross section properties No. 7. Required to describe concrete or composite girder reinforcement.
XSECT-H	XSH	420	Cross section properties No. 8. Describe steel angles in a riveted girder.
STIF-TRAN-GROUP	STG	422	Used to define a group of transverse stiffeners with similar material and geometry. Required for steel girders when using the schedule-based input option and transverse stiffeners are to be analyzed.
STIF-BEAR-GROUP	SBG	424	Used to define a group of bearing stiffeners that have similar material and geometry. Required for steel girders when using the schedule-based input option and bearing stiffeners are to be analyzed.
STIF-LONG-GROUP	SLG	426	Used to define a group of longitudinal stiffeners with similar geometry. Required for steel girders when using the schedule-based input option and longitudinal stiffeners to be analyzed.
STIRRUP-GROUP	SIG	428	Used to define a group of stirrups with similar material and geometry. Required for concrete girders when using the schedule-based input option and stirrups are to be analyzed.
XSECT-COORD1	XC1	430	Cross section properties No. 9. Required to define section by x-y coordinates.

XSECT-COORD2	XC2	440	Cross section properties No. 10. Required to define section by x-y coordinates.

SPAN DESCRIPTION:

SPAN-A	SPA	460	First in series. Required for each span as first of span series.
SPAN-B	SPB	470	Second in span series.
SPAN-RANGE	SPR	475	Used to allow the user to control the type of web depth variation within a span web depth range. Linear, elliptical (includes circular) and parabolic variations are allowed.
SPAN-C	SPC	480	Third in span series.
SPAN-D	SPD	490	Fourth in span series. Repeat as needed for additional cross section change points up to a maximum of 40.
STEEL-GIRDER-CONTROL	SGC	492	Used to define control parameters for spans on a steel girder structure. Required for each span when using the schedule-based input option.
STIFFENER-TRAN-SCHEDULE	STS	493	Used to define the transverse stiffener size and spacing schedule along a span. Required for steel girders when using the schedule-based input option and transverse stiffeners are to be analyzed.
STIFFENER-LONG-SCHEDULE	SLS	494	Used to define the longitudinal stiffener size schedule along a span. Required for steel girders when using the schedule-based input option and longitudinal stiffeners are to be analyzed.
BRACING-SCHEDULE	BRS	495	Used to define the location of girder cross braces along a span. Required for steel girders when using the schedule-based input option and cross bracing is a factor in the analysis.
LAT-SUPPORT-SCHEDULE	LTS	496	Used to define the lateral support of the top flange along a span. Required for steel girders when using the schedule-based input option and top flange lateral support is a factor in the analysis.
STIRRUP-SCHEDULE	SIS	497	Used to define the stirrup group and spacing along a span. Required for concrete girders when using the schedule-based input option and stirrups are to be analyzed.

SPAN-COPY	SCP	498	Duplicate identical spans.
FIXITY	FIX	500	Span end restraints. Place in order in span series.
FIX-SPRING	FIS	505	Span end restraint. Spring constant for modeling elastic supports.
STIF-BEAR-SCHEDULE	SBS	507	Used to define the location of bearing stiffeners by support points along a bridge. Required for steel girders when using the schedule-based input option and bearing stiffeners are to be analyzed.
SETTLEMENT	SET	510	Span end movements. One card per span may be used.
HINGE	HNG	520	Hinge or special analysis point location. Place in order in span series. Required if hinges or special analysis points in span.

GIRDER PROPERTIES:

PROPERTIES-ST1	PS1	530	Steel structure properties No. 1.
PROPERTIES-ST2	PS2	540	Steel structure properties No. 2.
PROPERTIES-RC	PRC	550	Reinforced concrete
PROPERTIES-RCB	PCB	560	Reinforced concrete ultimate strength preliminary and final run. Required if two different concrete strengths used.
PROPERTIES-TIM	PTM	570	Timber properties
PROPERTIES-PC1	PC1	580	Prestressed concrete properties No. 1.
PROPERTIES-PC2	PC2	590	Prestressed concrete properties No. 2.
PROPERTIES-PC3	PC3	600	Prestressed concrete properties. Losses computed by PCI Method.
PROPERTIES-PC4	PC4	610	Prestressed concrete properties No. 4. Losses computed by PCI Method.
PROPERTIES-PC5	PC5	620	Prestressed concrete properties No. 5. Losses computed by PCI Method.
PROPERTIES-PC6	PC6	625	Prestressed concrete properties for design.

PRESTRESS PROPERTIES:

STRAND-ST1	ST1	630	Prestressed concrete strand properties No. 1.

STRAND-ST2	ST2	640	Prestressed concrete strand properties No. 2.
STRAND-ST3	ST3	650	Prestressed concrete strand properties No. 3. Use when losses to be computed according to AASHTO 9.16.2.1.4.
STRAND-ST4	ST4	660	Prestressed concrete strand properties No. 4. Use when losses to be computed according to PCI general method.
STRAND-ST5	ST5	665	Prestressed concrete strand properties for design.
POST-TENSION1	PT1	670	Prestressed concrete strand properties. Required for post-tensioned strands.
POST-TENSION2	PT2	680	Prestressed concrete strand properties. Required for anchorage loss of post-tensioned strands.
CABLE-S1	CS1	690	Cable layout for straight reinforcement No. 1.
CABLE-S2	CS2	700	Cable layout for straight reinforcement No. 2.
CABLE-H1	CH1	710	Cable layout for harped strands.
CABLE-H2	CH2	720	Cable layout for harped strands.
CABLE-H3	CH3	730	Cable layout for identical evenly spaced rows.
CABLE-P1	CP1	740	Cable layout for parabolic draped strands.
CABLE-P2	CP2	750	Cable layout for parabolic draped strands.
CABLE-PC1	CB1	760	Cable layout for parabolic draped strands for continuous spans.
CABLE-PC2	CB2	770	Cable layout for parabolic draped strands for continuous spans.
CABLE-PC3	CB3	780	Cable layout for parabolic draped strands for continuous spans.
CABLE-DUP	DUP	810	Spans having identical cable layouts. Repeat as needed.
DEBOND	DBD	820	Length of debonded strand.

TRANSFER	XFR	823	Defines analysis points at the end of a transfer length of a strand.
PS-BEAM-OVERHANG	PBO	824	Define beam overhang distance for a prestress beam.
CABLE-DES	CDS	825	Geometry of prestressing strands for design.
PS-BEAM-SHEAR	PBS	826	Shear equation selection.

DEAD LOAD:

DEAD-LOAD	DLD	830	Control.
LOAD-DESCR	LDE	840	Load group description.
UNIFORM-DL1	UL1	850	Uniform dead load. One required for each section.
POINT-DL	PTD	860	Repeat for up to 70 point loads.
TEMP-SETL	TSL	870	Temperature and settlement stage control.

LIVE LOAD:

LIVE-LOAD	LLD	880	Live load control
TRUCK-WFR	TRW	900	Wheel fraction override. Repeat for trucks 7-10.
TRUCK-IMP	TRI	910	Impact factor override. Repeat for trucks 7-10.
TRUCK-CODE1	TR1	920	Truck code No. 1. Not required if standard design trucks asked for or SPECIAL TRUCKS or SPECIAL LANE commands to follow.
TRUCK-CODE2	TR2	930	Truck code No. 2.
SPECIAL-TRUCK	STR	940	Up to 24 axles on up to 10 trucks. Repeat as needed.
SPECIAL-LANE	SLN	950	Special lane load. Up to 5 allowable.
AXLE-WF	AWF	960	Define a wheel fraction per axle.
FLOORBEAM-CONTROL	FBC	970	Define live load positioning parameters and output when analyzing floorbeams.
FLOORBEAM-TRAVELWAY	FBW	972	Define travelway limits when analyzing floorbeams.
FLOORBEAM-TRUCK	FBT	974	Define truck when analyzing floorbeams.

FLOORBEAM-TRUCK-AXLE	FBA	976	Define axle loads and spacings for a truck associated with a floorbeam analysis.
FLOORBEAM-MPT	FBM	978	Define lane width, axle loads, and spacings for a multiple presence truck associated with a floorbeam analysis.

SECTION ANALYSIS:

DESIGN	DES	980	Design, review or rating control.
INVENTORY	INV	990	Working strength stress levels for design or inventory rating of steel or non-prestressed concrete girders. Ultimate strength analysis or inventory rating of prestressed or non-prestressed concrete girders.
OPERATING	OPG	1000	Working strength stress levels for design or operating rating of steel or non-prestressed concrete girders. Ultimate strength analysis or operating rating of prestressed or non-prestressed concrete girders.
POSTING	PST	1010	Working strength stress levels for design or posting rating of steel or non-prestressed concrete girders. Ultimate strength analysis or posting rating of prestressed or non-prestressed concrete girders.
SAFE-LOAD	SLD	1020	Working strength stress levels for design or safe load capacity rating of steel or non-prestressed concrete girders. Ultimate strength analysis or safe load capacity rating of prestressed or non-prestressed concrete girders.
LOAD-LEVEL-1	LL1	1021	Load combination 1.3(D + 1.67L) for steel girder ultimate strength analysis.
LOAD-LEVEL-2	LL2	1022	Load combination D + 1.67L for steel girder ultimate strength analysis.
LOAD-LEVEL-3	LL3	1023	Load combination 1.3(D + L) for steel girder ultimate strength analysis.
LOAD-LEVEL-4	LL4	1024	Load combination D + L for steel girder ultimate strength analysis.
POINT-OF-INTEREST	POI	1025	Used to designate analysis points (points of interest) on the bridge when using the schedule-based input option. Optional.

INTERMEDIATE-OUTPUT	INO	1026	Used to designate analysis points for which intermediate output for the AASHTO specification checks are desired. This command is optional and used with the schedule-based input option.

STEEL SECTION:

STEEL-1	SL1	1030	Steel girder section details No. 1.
STEEL-2	SL2	1040	Steel girder section details No. 2.
STEEL-3	SL3	1050	Steel girder section details No. 3.
STEEL-4	SL4	1060	Steel girder section details No. 4.
STEEL-5	SL5	1065	Steel girder section details No. 5. Required for splice design.
STEEL-6	SL6	1066	Steel girder section details No. 6. Required for splice design.

CONCRETE SECTION:

CONCRETE-1	CR1	1080	Concrete girder section details No. 1.
CONCRETE-2	CR2	1090	Concrete girder section details No. 2.
CONCRETE-3	CR3	1100	Concrete girder section details. Ultimate strength preliminary and final run.
CONCRETE-4	CR4	1110	Concrete girder section details. Ultimate strength preliminary run.
CONCRETE-5	CR5	1120	Concrete girder section details. Ultimate strength preliminary run.
CONCRETE-6	CR6	1130	Concrete girder section details. Ultimate strength preliminary box-girder run and all final runs. Required for each span.
CONCRETE-7	CR7	1140	Concrete girder section details. Ultimate strength final run. Required for each group.
CONCRETE-8	CR8	1150	Concrete girder section details. Ultimate strength final run. Required for each 2 bars. Repeat as needed.
CONCRETE-9	CR9	1160	Concrete girder section details. Ultimate strength final run and preliminary run.

PRESTRESS SECTION:

PRESTRESS-1	PR1	1170	Prestress girder section details ultimate strength.

PRESTRESS-2	PR2	1180	Prestress girder details.
PRESTRESS-3	PR3	1181	Prestress concrete girder details for design.
PRESTRESS-4	PR4	1182	Prestress concrete girder details for design.
PRESTRESS-5	PR5	1183	Prestress concrete girder details for design.
PRESTRESS-6	PR6	1184	Prestress concrete girder details for design.

TIMBER SECTION:

TIMBER	TMB	1190	Timber girder section details.

TRUCK FILE EDIT:

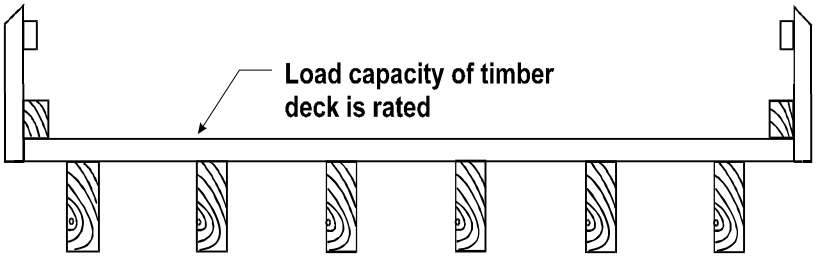
NEW-TRUCK-1	NT1	1200
NEW-TRUCK-2	NT2	1210
NEW-TRUCK-3	NT3	1220
DELETE-TRUCK	DTK	1230
PRINT-TRUCK	PTK	1240

STANDARD SECTION FILE EDIT:

NEW-SECT-1	NS1	1250
NEW-SECT-2	NS2	1260
NEW-SECT-3	NS3	1270
NEW-SECT-4	NS4	1280
NEW-SECT-5	NS5	1290
NEW-SECT-6	NS6	1300
NEW-SECT-7	NS7	1310
NEW-SECT-8	NS8	1320
DELETE-SECT	DSC	1330
PRINT-SECT	PSC	1340

4. TYPICAL COMMAND SETS

1. Timber bridge deck rating.

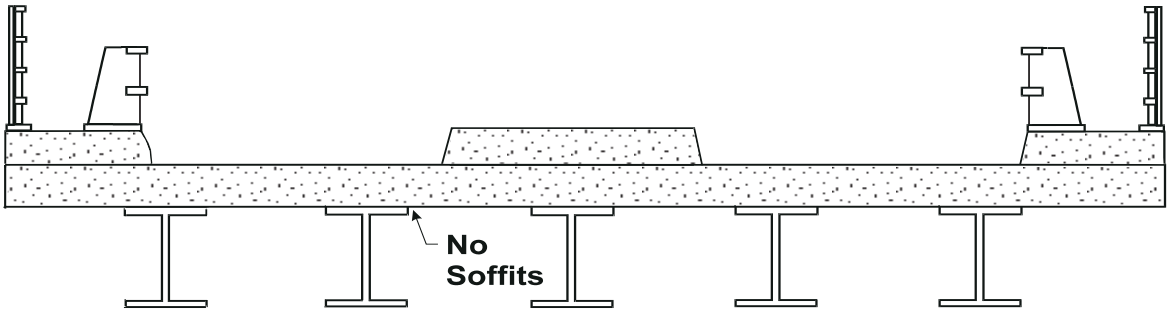


COMMAND	ABBR	COMMAND NUMBER	USAGE
AGENCY ♯	AGY	1	Optional
BRIDGE-NAME ♯	BRN	2	Optional
LOCATION ♯	LOC	3	Optional
ENGINEER ♯	ENG	4	Optional
TITLE	TLE	10	Required
COMMENT *	COM	20	Optional
INCLUDE *	INC	25	Optional
DECK-CON	DCN	60	Required
DECKT-G1	DG1	220	Required
DECKT-G2	DG2	230	Required
DECKT-G3	DG3	240	Optional
DECKT-LWT1	DL1	250	Optional
DECKT-LWT2	DL2	260	Optional
DECKT-LWT3	DL3	270	Optional
DECKT-LWT4	DL4	280	Optional
DECK-TRK1	DT1	290	Required
DECK-TRK2	DT2	300	Optional
END	END	28	Optional

♯ Due to space constraints, no dialog screens are available in the Graphical User Interface.

✶ These commands may be placed anywhere in the input data set.

2. Reinforced Concrete Bridge Deck rating.



Uniform Girder Spacing

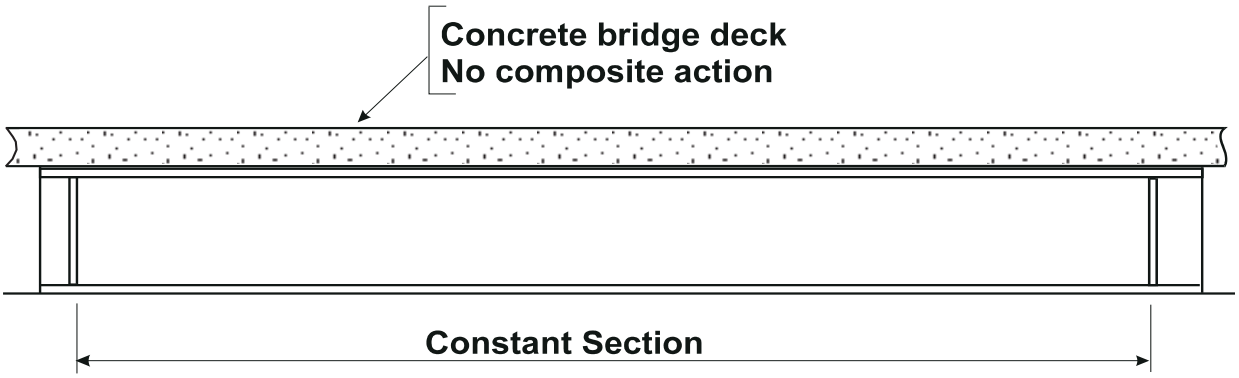
Figure 20

COMMAND	ABBR	COMMAND NUMBER	USAGE
AGENCY ♯	AGY	1	Optional
BRIDGE-NAME ♯	BRN	2	Optional
LOCATION ♯	LOC	3	Optional
ENGINEER ♯	ENG	4	Optional
TITLE	TLE	10	Required
COMMENT *	COM	20	Optional
INCLUDE *	INC	25	Optional
DECK-CON	DCN	60	Required
DECK-MAT	DMT	90	Optional
DECKC-STR1	DS1	100	Optional
DECKC-STR2	DS2	110	Optional
DECKC-STR3	DS3	115	Optional
DECKC-DIM1	DD1	120	Required
DECKC-DIM2	DD2	130	Required
DECKC-DIM3	DD3	140	Required
DECKC-BARA	DBA	180	Required
DECKC-LODG	DLG	190	Optional
DECKC-LODC	DLC	200	Optional
DECK-TRK1	DT1	290	Required
DECK-TRK2	DT2	300	Optional
END	END	28	Optional

♯ Due to space constraints, no dialog screens are available in the Graphical User Interface.

✶ These commands may be placed anywhere in the input data set.

3. Simple Span Wide Flange Girder Bridge Rating.



COMMAND	ABBR	COMMAND NUMBER		USAGE
AGENCY ♯	AGY	1		Optional
BRIDGE-NAME ♯	BRN	2		Optional
LOCATION ♯	LOC	3		Optional
ENGINEER ♯	ENG	4		Optional
TITLE	TLE	10		Required
COMMENT *	COM	20		Optional
INCLUDE *	INC	25		Optional
ANALYSIS	ANL	310		Required
XSECT-STD	XST	340		Required
STIF-TRAN-GROUP ♠	STG	422		Optional
STIF-BEAR-GROUP ♠	SBG	424		Optional
STIF-LONG-GROUP ♠	SLG	426		Optional
SPAN-A	SPA	460		Required
SPAN-C	SPC	480		Required
STEEL-GIRDER-CONTROL ♠	SGC	492		Optional
STIF-TRAN-SCHEDULE ♠	STS	493		Optional
STIF-LONG-SCHEDULE ♠	SLS	494		Optional
BRACING-SCHEDULE ♠	BRS	495		Optional
LAT-SUPPORT-SCHEDULE ♠	LTS	496		Optional
FIXITY	FIX	500		Optional
STIF-BEAR-SCHEDULE ♠	SBS	507		Optional
HINGE ♯	HNG	520		Optional
PROPERTIES-ST1	PS1	530		Optional
TRANSFER ♯	XFR	823		Optional
DEAD-LOAD	DLD	830		Required
LIVE-LOAD	LLD	880		Required
TRUCK-WFR	TRW	900		Optional
TRUCK-IMP	TRI	910		Optional
TRUCK-CODE1	TR1	920	One or more is required	Optional
TRUCK-CODE2	TR2	930	to define live load if	Optional
SPECIAL-TRUCK	STR	940	parameter 6 of Live	Optional
SPECIAL-LANE	SPN	950	Load command is blank.	Optional

COMMAND	ABBR	COMMAND NUMBER		USAGE
AXLE-WF	AWF	960		Optional
DESIGN	DES	980		Required
INVENTORY ⊙	INV	990		Optional
OPERATING	OPG	1000		Optional
POSTING	PST	1010		Optional
SAFE-LOAD	SLD	1020		Optional
LOAD-LEVEL-1 †	LL1	1021		Optional
LOAD-LEVEL-2 †	LL2	1022		Optional
LOAD-LEVEL-3 †	LL3	1023		Optional
LOAD-LEVEL-4 †	LL4	1024		Optional
POINT-OF-INTEREST ♠	POI	1025		Optional
INTERMEDIATE-OUTPUT ♠	INO	1026		Optional
STEEL-1	SL1	1030		Required
STEEL-2	SL2	1040	Required for each	Optional
STEEL-3	SL3	1050	analysis point desired.	Optional
STEEL-4	SL4	1060		Required
END	END	28		Optional

♯ Due to space constraints, no dialog screens are available in the Graphical User Interface.

✶ These commands may be placed anywhere in the input data set.

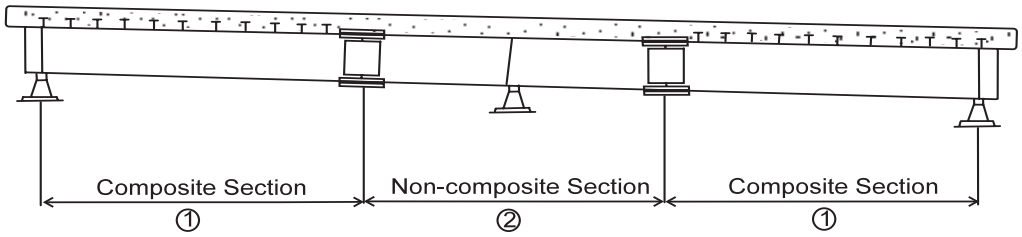
♠ These commands are used when the schedule-based option is selected. Due to space constraints, no dialog screens are available in the Graphical User Interface.

ƒ The HINGE and TRANSFER commands may be used to specify additional special analysis points (node points).

⊙ Required for Allowable Stress Design (ASD) rating.

† Required for Load Factor Design (LFD) rating. Due to space constraints, no dialog screens are available in the Graphical User Interface.

4. Two Span Composite Steel and Concrete Welded Plate Girder Bridge Rating.



Typical cross-section code

COMMAND	ABBR	COMMAND NUMBER		USAGE
AGENCY ♯	AGY	1		Optional
BRIDGE-NAME ♯	BRN	2		Optional
LOCATION ♯	LOC	3		Optional
ENGINEER ♯	ENG	4		Optional
TITLE	TLE	10		Required
COMMENT *	COM	20		Optional
INCLUDE *	INC	25		Optional
ANALYSIS	ANL	310		Required
XSECT-A	XSA	350		Required
XSECT-B	XSB	360	Cross Section 1	Required
XSECT-C	XSC	370		Required
XSECT-G	XSG	410		Optional
XSECT-A	XSA	350		Required
XSECT-B	XSB	360	Cross Section 2	Required
XSECT-C	XSC	370		Required
XSECT-G	XSG	410		Optional
STIF-TRAN-GROUP ♠	STG	422		Optional
STIF-BEAR-GROUP ♠	SBG	424		Optional
STIF-LONG-GROUP ♠	SLG	426		Optional
SPAN-A	SPA	460		Required
SPAN-C	SPC	480		Required
SPAN-D	SPD	490		Required
STEEL-GIRDER-CONTROL ♠	SGC	492		Optional
STIF-TRAN-SCHEDULE ♠	STS	493	Span 1	Optional
STIF-LONG-SCHEDULE ♠	SLS	494		Optional
BRACING-SCHEDULE ♠	BRS	495		Optional
LAT-SUPPORT-SCHEDULE ♠	LTS	496		Optional
FIXITY	FIX	500		Required
STIF-BEAR-SCHEDULE ♠	SBS	507		Optional
HINGE ♯	HNG	520		Optional
SPAN-A	SPA	460		Required
SPAN-C	SPC	480		Required
SPAN-D	SPD	490		Required
STEEL-GIRDER-CONTROL ♠	SGC	492		
	Optional			
STIF-TRAN-SCHEDULE ♠	STS	493	Span 2	Optional
STIF-LONG-SCHEDULE ♠	SLS	494		Optional
BRACING-SCHEDULE ♠	BRS	495		Optional
LAT-SUPPORT-SCHEDULE ♠	LTS	496		Optional

COMMAND	ABBR	COMMAND NUMBER		USAGE
SPAN-COPY ♦	SCP	498		Optional
FIXITY	FIX	500		Required
STIF-BEAR-SCHEDULE ♠	SBS	507		Optional
HINGE ♯	HNG	520		Optional
PROPERTIES-ST1	PS1	530		Required
PROPERTIES-ST2	PS2	540		Required
TRANSFER ♯	XFR	823		Optional
DEAD-LOAD	DLD	830		Required
LOAD-DESCR	LDE	840		Optional
UNIFORM-DL1	UL1	850		Optional
POINT-DL	PTD	860		Optional
LIVE-LOAD	LLD	880		Required
TRUCK-WFR	TRW	900		Optional
TRUCK-IMP	TRI	910		Optional
TRUCK-CODE1	TR1	920	One or more required	Optional
TRUCK-CODE2	TR2	930	to define live load if	Optional
SPECIAL-TRUCK	STR	940	parameter 6 of Live	Optional
SPECIAL-LANE	SPN	950	Load Command is blank	Optional
AXLE-WF	AWF	960		Optional
DESIGN	DES	980		Required
INVENTORY ⊙	INV	990		Optional
OPERATING	OPG	1000		Optional
POSTING	PST	1010		Optional
SAFE-LOAD	SLD	1020		Optional
LOAD-LEVEL-1 †	LL1	1021		Optional
LOAD-LEVEL-2 †	LL2	1022		Optional
LOAD-LEVEL-3 †	LL3	1023		Optional
LOAD-LEVEL-4 †	LL4	1024		Optional
POINT-OF-INTEREST ♠	POI	1025		Optional
INTERMEDIATE-OUTPUT ♠	INO	1026		Optional
STEEL-1	SL1	1030		Required
STEEL-2	SL2	1040	One set for each	Required
STEEL-3	SL3	1050	analysis point desired	Required
STEEL-4	SL4	1060		Required

♯ Due to space constraints, no dialog screens are available in the Graphical User Interface.

✶ These commands may be placed anywhere in the input data set.

♠ These commands are used when the schedule-based option is selected. Due to space constraints, no dialog screens are available in the Graphical User Interface.

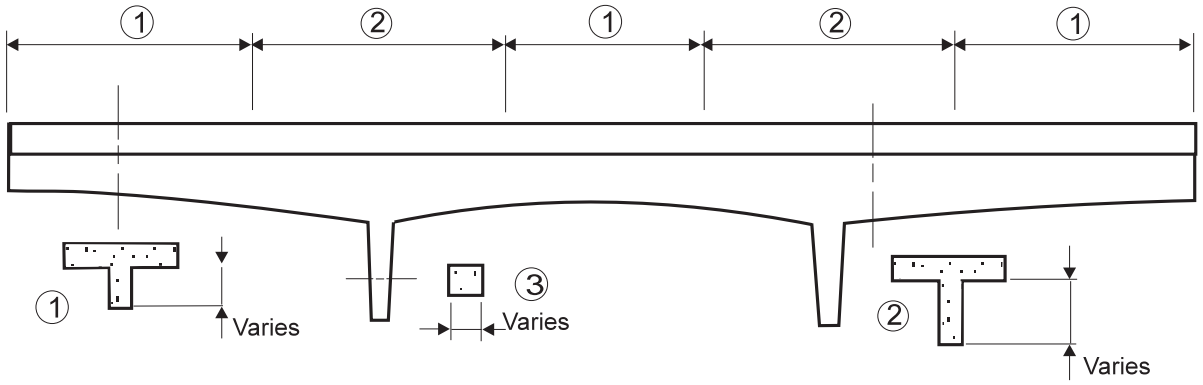
♦ SPAN-COPY may be used in lieu of SPAN-A through SPAN-D commands. See provisions on page 10.30.

♯ The HINGE and TRANSFER commands may be used to specify additional special analysis points (node points).

⊙ Required for Allowable Stress Design (ASD) rating.

† Required for Load Factor Design (LFD) rating. Due to space constraints, no dialog screens are available in the Graphical User Interface.

5. Three span concrete girder or parabolically haunched reinforced concrete T girder bridge with integral columns. Girder rating.



COMMAND	ABBR	COMMAND NUMBER		USAGE
AGENCY ♯	AGY	1		Optional
BRIDGE-NAME ♯	BRN	2		Optional
LOCATION ♯	LOC	3		Optional
ENGINEER ♯	ENG	4		Optional
TITLE	TLE	10		Required
COMMENT *	COM	20		Optional
INCLUDE *	INC	25		Optional
ANALYSIS	ANL	310		Required
XSECT-A	XSA	350		Required
XSECT-B	XSB	360	Cross Section 1	Required
XSECT-G	XSG	410		Required
XSECT-A	XSA	350		Required
XSECT-B	XSB	360	Cross Section 2	Required
XSECT-G	XSG	410		Required
XSECT-A	XSA	350		Required
XSECT-B	XSB	360	Cross Section 3	Required
XSECT-G	XSG	410		Required
STIRRUP-GROUP ♠	SIG	428		Optional
SPAN-A	SPA	460		Required
SPAN-B	SPB	470		Required
SPAN-C	SPC	480	Span 1	Required
SPAN-D	SPD	490		Required
STIRRUP-SCHEDULE ♠	SIS	497		Optional
FIXITY	FIX	500		Required
HINGE ƒ	HNG	520		Optional
SPAN-A	SPA	460		Required
SPAN-B	SPB	470		Required
SPAN-C	SPC	480		Required
SPAN-D	SPD	490	Span 2	Required
STIRRUP-SCHEDULE ♠	SIS	497		Optional
SPAN-COPY ♦	SCP	498		Optional
FIXITY	FIX	500		Required
HINGE ƒ	HNG	520		Optional
SPAN-A	SPA	460		Required
SPAN-B	SPB	470		Required
SPAN-C	SPC	480		Required

COMMAND	ABBR	COMMAND NUMBER		USAGE
SPAN-D	SPD	490	Span 3	Required
STIRRUP-SCHEDULE ♠	SIS	497		Optional
SPAN-COPY ♦	SCP	498		Optional
FIXITY	FIX	500		Required
HINGE ǂ	HNG	520		Optional
SPAN-A	SPA	460		Required
SPAN-C	SPC	480		Required
SPAN-D	SPD	490	Span 8	Required
STIRRUP-SCHEDULE ♠	SIS	497		Optional
FIXITY	FIX	500		Required
HINGE ǂ	HNG	520		Optional
SPAN-A	SPA	460		Required
SPAN-C	SPC	480		Required
SPAN-D	SPD	490	Span 9	Required
STIRRUP-SCHEDULE ♠	SIS	497		Optional
SPAN-COPY ♦	SCP	498		Optional
FIXITY	FIX	500		Required
HINGE ǂ	HNG	520		Optional
PROPERTIES-RC	PRC	550		Required
TRANSFER ǂ	XFR	823		Optional
DEAD-LOAD	DLD	830		Required
LOAD-DESCR	LDE	840		Optional
UNIFORM-DL1	UL1	850		Optional
POINT-DL	PTD	860		Optional
TEMP-SETL	TSL	870		Optional
LIVE-LOAD	LLD	880		Required
TRUCK-IMP	TRI	910		Optional
TRUCK-CODE1	TR1	920	One or more required to	Optional
TRUCK-CODE2	TR2	930	define live loads if	Optional
SPECIAL-TRUCK	STR	940	parameter 6 of Live	Optional
SPECIAL-LANE	SPN	950	LLOAD Command is blank.	Optional
AXLE-WF	AWF	960		Optional
DESIGN	DES	980		Required
INVENTORY	INV	990		Optional
OPERATING	OPG	1000	One or more	Optional
POSTING	PST	1010	required for rating.	Optional
SAFE-LOAD	SLD	1020		Optional
POINT-OF-INTEREST ♠	POI	1025		Optional
INTERMEDIATE-OUTPUT ♠	INO	1026		Optional
CONCRETE-1	CR1	1080	One set for each	Required
CONCRETE-2	CR2	1090	point to be rated.	Required

♯ Due to space constraints, no dialog screens are available in the Graphical User Interface.

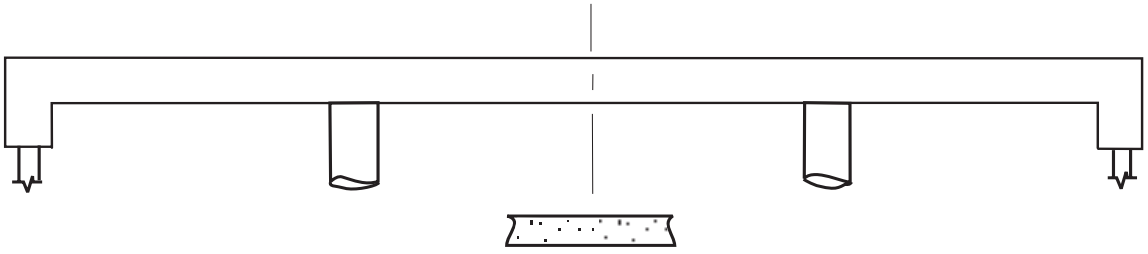
✶ These commands may be placed anywhere in the input data set.

♦ SPAN-COPY may be used in lieu of SPAN-A through SPAN-D commands. See provisions on page 10.30.

♠ These commands are used when the schedule-based option is selected. Due to space constraints, no dialog screens are available in the Graphical User Interface.

ǂ The HINGE and TRANSFER commands may be used to specify additional special analysis points (node points).

6. Three span reinforced concrete slab bridge. Preliminary run for ultimate strength design only. NOTE: The option to use schedule-based input of stirrups and other shear data does not apply to the ultimate strength design option, so can not be used for this example. Also, do not exceed five spans.



Commands for concrete T girder and box girder are the same as those listed for the slab bridge, except the XSECT-D command is an optional command. Also, the CONCRETE-6 command is required only for a box girder as noted.

COMMAND	ABBR	COMMAND NUMBER	USAGE
AGENCY ♯	AGY	1	Optional
BRIDGE-NAME ♯	BRN	2	Optional
LOCATION ♯	LOC	3	Optional
ENGINEER ♯	ENG	4	Optional
TITLE	TLE	10	Required
COMMENT *	COM	20	Optional
INCLUDE *	INC	25	Optional
SYSTEM-1	SY1	30	Optional
ANALYSIS	ANL	310	Required
XSECT-A	XSA	350	Required
XSECT-B	XSB	360	Required
SPAN-A	SPA	460	Required
SPAN-B	SPB	470	Optional
SPAN-C	SPC	480	Required
FIXITY	FIX	500	Optional
SPAN-A	SPA	460	Required
SPAN-B	SPB	470	Optional
SPAN-C	SPC	480	Required
SPAN-COPY ♦	SCP	498	Optional
FIXITY	FIX	500	Optional
SPAN-A	SPA	460	Required
SPAN-B	SPB	470	Optional
SPAN-C	SPC	480	Required
SPAN-COPY ♦	SCP	498	Optional
FIXITY	FIX	500	Optional
PROPERTIES-RC	PRC	550	Required
PROPERTIES-RCB	PCB	560	Optional
DEAD-LOAD	DLD	830	Required
LOAD-DESCR	LDE	840	Optional
UNIFORM-DL1	UL1	850	Optional
POINT-DL	PTD	860	Optional
LIVE-LOAD	LLD	880	Required
TRUCK-WFR	TRW	900	Optional

COMMAND	ABBR	COMMAND NUMBER		USAGE
TRUCK-IMP	TRI	910		Optional
TRUCK-CODE1	TR1	920	One or more required	Optional
TRUCK-CODE2	TR2	930	to define live loads	Optional
SPECIAL-TRUCK	STR	940	if parameter 6 of Live	Optional
SPECIAL-LANE	SLN	950	Load Command is blank.	Optional
AXLE-WF	AWF	960		Optional
DESIGN	DES	980		Required
INVENTORY	INV	990		Optional
CONCRETE-3	CR3	1100		Required
CONCRETE-4	CR4	1110		Required
CONCRETE-5	CR5	1120		Required
CONCRETE-6 ϕ	CR6	1130		Optional
CONCRETE-6 ϕ	CR6	1130		Optional
CONCRETE-6 ϕ	CR6	1130		Optional
CONCRETE-9	CR9	1160		Required
END	END	28		Optional

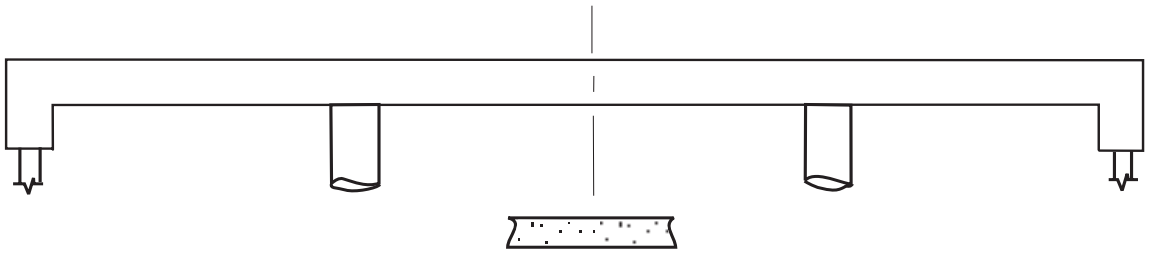
♯ Due to space constraints, no dialog screens are available in the Graphical User Interface.

✶ These commands may be placed anywhere in the input data set.

♦ SPAN-COPY may be used in lieu of SPAN-A through SPAN-D commands. See provisions on page 10.30.

ϕ The CONCRETE-6 command is required and used only for a box-girder.

7. Three span reinforced concrete slab. **Final** run for ultimate strength design only. NOTE: The option to use schedule-based input of stirrups and other shear data does not apply to the ultimate strength design option, so can not be used for this example. Also, do not exceed five spans.



Commands for concrete T and box girder are the same as those listed for the slab bridge, except the XSECT-D command is an optional command.

COMMAND	ABBR	COMMAND NUMBER	USAGE
AGENCY ♯	AGY	1	Optional
BRIDGE-NAME ♯	BRN	2	Optional
LOCATION ♯	LOC	3	Optional
ENGINEER ♯	ENG	4	Optional
TITLE	TLE	10	Required
COMMENT *	COM	20	Optional
INCLUDE *	INC	25	Optional
SYSTEM-1	SY1	30	Optional
ANALYSIS	ANL	310	Required
XSECT-A	XSA	350	Required
XSECT-B	XSB	360	Required
SPAN-A	SPA	460	Required
SPAN-C	SPC	480	Required
FIXITY	FIX	500	Optional
SPAN-A	SPA	460	Required
SPAN-C	SPC	480	Required
SPAN-COPY ♦	SCP	498	Optional
FIXITY	FIX	500	Optional
SPAN-A	SPA	460	Required
SPAN-C	SPC	480	Required
SPAN-COPY ♦	SCP	498	Optional
FIXITY	FIX	500	Optional
PROPERTIES-RC	PRC	550	Required
PROPERTIES-RCB	PCB	560	Optional
DEAD-LOAD	DLD	830	Required
LOAD-DESCR	LDE	840	Optional
UNIFORM-DL1	UL1	850	Optional
POINT-DL	PTD	860	Optional
LIVE-LOAD	LLD	880	Required
TRUCK-WFR	TRW	900	Optional
TRUCK-IMP	TRI	910	Optional

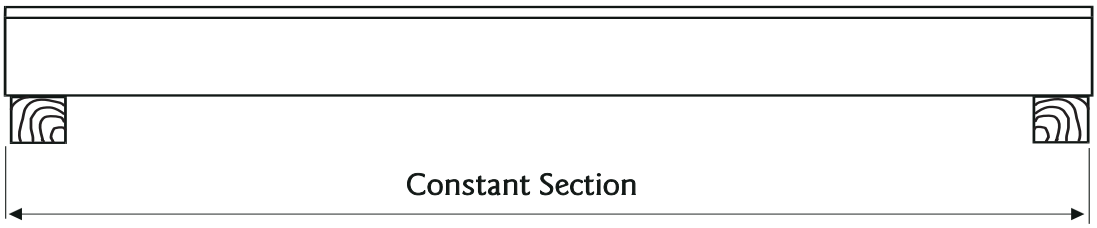
COMMAND	ABBR	COMMAND NUMBER		USAGE
TRUCK-CODE1	TR1	920	One or more required	Optional
TRUCK-CODE2	TR2	930	to define live loads	Optional
SPECIAL-TRUCK	STR	940	if parameter 6 of Live	Optional
SPECIAL-LANE	SLN	950	Load Command is blank	Optional
AXLE-WF	AWF	960		Optional
DESIGN	DES	980		Required
INVENTORY	INV	990		Optional
CONCRETE-3	CR3	1100		Required
CONCRETE-6	CR6	1130		Required
CONCRETE-7	CR7	1140	Required for each group in span.	Span 1
CONCRETE-8	CR8	1150	Required for each 2 bars and/or bar sets in group.	Span 1
CONCRETE-6	CR6	1130		Required
CONCRETE-7	CR7	1140	Required for each group in span.	Span 2
CONCRETE-8	CR8	1150	Required for each 2 bars and/or bar sets in group.	Span 2
CONCRETE-6	CR6	1130		Required
CONCRETE-7	CR7	1140	Required for each group in span.	Span 3
CONCRETE-8	CR8	1150	Required for each 2 bars and/or bar sets in group.	Span 3
CONCRETE-9	CR9	1160		Required
END	END	28		Optional

♯ Due to space constraints, no dialog screens are available in the Graphical User Interface.

✶ These commands may be placed anywhere in the input data set.

♦ SPAN-COPY may be used in lieu of SPAN-A through SPAN-D commands. See provisions on page 10.30.

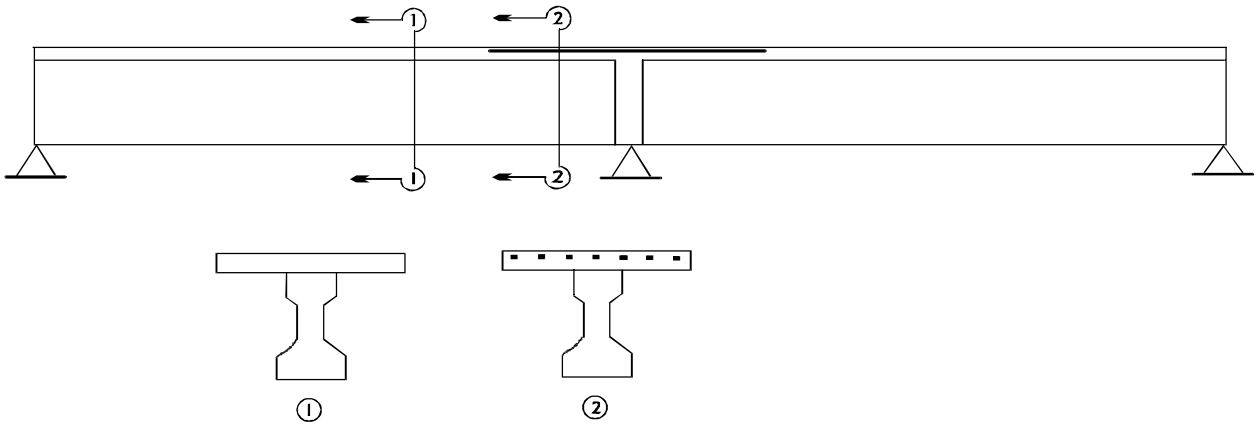
8. Simple span timber bridge with plank deck. Rate deck and girder.



COMMAND	ABBR	COMMAND NUMBER		USAGE
AGENCY ♯	AGY	1		Optional
BRIDGE-NAME ♯	BRN	2		Optional
LOCATION ♯	LOC	3		Optional
ENGINEER ♯	ENG	4		Optional
TITLE	TLE	10		Required
COMMENT *	COM	20		Optional
INCLUDE *	INC	25		Optional
DECK-CON	DCN	60		Required
DECKT-G1	DG1	220		Required
DECKT-G2	DG2	230	One is Required	Optional
DECKT-G3	DG3	240	for rating.	Optional
DECKT-LWT1	DL1	250		Optional
DECKT-LWT2	DL2	260		Optional
DECKT-LWT3	DL3	270		Optional
DECKT-LWT4	DL4	280		Optional
DECK-TRK1	DT1	290		Required
DECK-TRK2	DT2	300		Optional
ANALYSISANL	310		Required	
XSECT-A	XSA	350		Required
XSECT-B	XSB	360		Required
SPAN-A	SPA	460		Required
SPAN-C	SPC	480		Required
FIXITY	FIX	500		Optional
HINGE ♯	HNG	520		Optional
PROPERTIES-TIM	PTM	570		Required
TRANSFER ♯	XFR	823		Optional
DEAD-LOAD	DLD	830		Required
LOAD-DESCR	LDE	840		Optional
UNIFORM-DL1	UL1	850		Optional
POINT-DL	PTD	860		Optional
LIVE-LOAD	LLD	880		Required
TRUCK-WFR	TRW	900		Optional
TRUCK-IMP	TRI	910	One or more is required	Optional
TRUCK-CODE1	TR1	920	to define live load if	Optional
TRUCK-CODE2	TR2	930	parameter 6 of Live	Optional
SPECIAL-TRUCK	STR	940	Load command is blank.	Optional
SPECIAL-LANE	SPN	950		Optional
AXLE-WF	AWF	960		Optional
DESIGN	DES	980		Required
INVENTORY	INV	990		Optional
OPERATING	OPG	1000	One or more required	Optional
POSTING	PST	1010	for rating.	Optional
SAFE-LOAD	SLD	1020		Optional
TIMBER	TMB	1190		Required

♯ Due to space constraints, no dialog screens are available in the Graphical User Interface.
✶ These commands may be placed anywhere in the input data set.
ǂ The HINGE and TRANSFER commands may be used to specify additional special analysis points (node points).

9. Two span prestressed, AASHTO I-Girder - composite-design. NOTE: The option to use schedule-based input of stirrups and other shear data does not apply to the design of a prestressed concrete girder, so can not be used for this example.



COMMAND	ABBR	COMMAND NUMBER		USAGE
AGENCY ♯	AGY	1		Optional
BRIDGE-NAME ♯	BRN	2		Optional
LOCATION ♯	LOC	3		Optional
ENGINEER ♯	ENG	4		Optional
TITLE	TLE	10		Required
COMMENT *	COM	20		Optional
INCLUDE *	INC	25		Optional
SYSTEM-1	SY1	30		Optional
ANALYSIS	ANL	310		Required
XSECT-STD ♠	XST	340		Optional
XSECT-A	XSA	350		Optional
XSECT-B	XSB	360		Optional
XSECT-C	XSC	370		Optional
XSECT-D	XSD	380		Optional
XSECT-E	XSE	390		Optional
SPAN-A	SPA	460		Required
SPAN-C	SPC	480	Span 1	Required
FIXITY	FIX	500		Required
HINGE ∮	HNG	520		Optional
SPAN-A	SPA	460		Required
SPAN-C	SPC	480	Span 2	Required
FIXITY	FIX	500		Optional
SPAN-COPY ♦	SCP	498		Optional
HINGE ∮	HNG	520		Optional
PROPERTIES-PC1	PC1	580		Required
PROPERTIES-PC2	PC2	590		Optional
PROPERTIES-PC6	PC6	625		Optional
STRAND-ST5	ST5	665		Required

COMMAND	ABBR	COMMAND NUMBER		USAGE
CABLE-DES	CDS	825		Required
DEAD-LOAD	DLD	830		Required
LIVE-LOAD	LLD	880		Required
TRUCK-CODE1 ✯	TR1	920		Optional
AXLE-WF	AWF	960		Optional
DESIGN	DES	980		Required
PRESTRESS-3	PR3	1181	One set required for	Required
PRESTRESS-4	PR4	1182	each span.	Optional
PRESTRESS-5	PR5	1183		Optional
PRESTRESS-6	PR6	1184		Optional
END	END	28		Optional

♯ Due to space constraints, no dialog screens are available in the Graphical User Interface.

✶ These commands may be placed anywhere in the input data set.

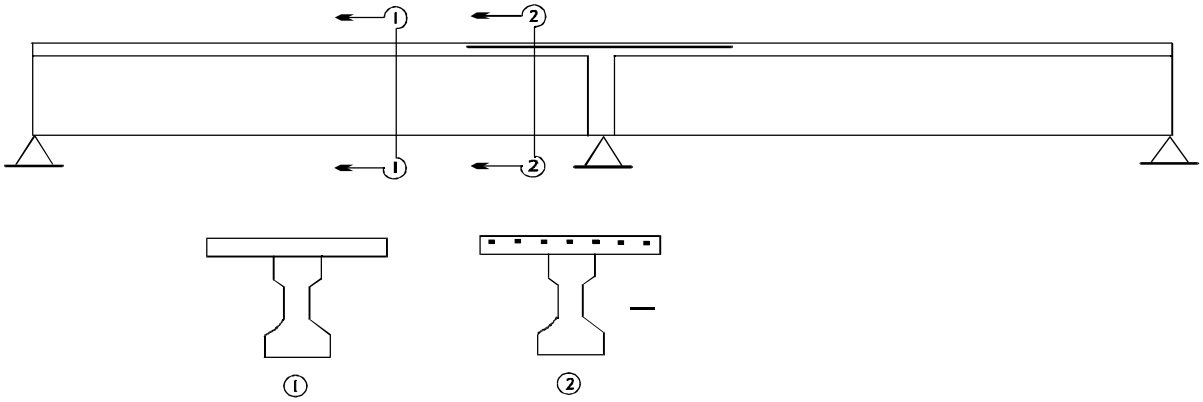
♠ The XSECT-COORD1 and XSECT-COORD2 commands may not be used for prestressed concrete girder design.

♦ SPAN-COPY may be used in lieu of SPAN-A through SPAN-D commands. See provisions on page 10.30.

✯ A minimum of two trucks (HS20T and LANEHS20) are required when designing a Prestressed Concrete Girder.

ƒ The HINGE command may be used to specify additional special analysis points (node points).

10. Two Span prestressed, AASHTO I-Girder-composite-rating.



COMMAND	ABBR	COMMAND NUMBER		USAGE
AGENCY ♯	AGY	1		Optional
BRIDGE-NAME ♯	BRN	2		Optional
LOCATION ♯	LOC	3		Optional
ENGINEER ♯	ENG	4		Optional
TITLE	TLE	10		Required
COMMENT *	COM	20		Optional
INCLUDE *	INC	25		Optional
SYSTEM-1	SY1	30		Optional
ANALYSIS	ANL	310		Required
XSECT-STD (1)	XST	340		Required
XSECT-A	XSA	350	Required to define	Optional
XSECT-C (2)	XSC	370	composite slab.	Optional
XSECT-G	XSG	410	Required when reinforcing steel in composite slab over support.	Optional
STIRRUP-GROUP ♠	SIG	428		Optional
SPAN-A	SPA	460		Required
SPAN-C	SPC	480	Span 1	Required
STIRRUP-SCHEDULE ♠	SIS	497		Optional
FIXITY	FIX	500		Optional
HINGE ∮	HNG	520		Optional
SPAN-A	SPA	460		Required
SPAN-C	SPC	480	Span 2	Required
SPAN-COPY ♦	SCP	498		Optional
STIRRUP-SCHEDULE ♠	SIS	497		Optional
FIXITY	FIX	500		Required
HINGE ∮	HNG	520		Optional
PROPERTIES-PC1	PC1	580		Required
PROPERTIES-PC2	PC2	590		Required
PROPERTIES-PC3	PC3	600	Required when	Optional
PROPERTIES-PC4	PC4	610	prestress losses	Optional
PROPERTIES-PC5	PC5	620	to be calculated by PCI general method.	Optional
STRAND-ST1	ST1	630		Required
STRAND-ST2	ST2	640		Optional
STRAND-ST3	ST3	650	One set required for	Optional
STRAND-ST4	ST4	660	each type of	Optional
POST-TENSION1	PT1	670	prestressing strand.	Optional
POST-TENSION2	PT2	680		Optional
CABLE-S1	CS1	690		Optional

COMMAND	ABBR	COMMAND NUMBER		USAGE
CABLE-S2	CS2	700		Optional
CABLE-H1	CH1	710	Use as required to	Optional
CABLE-H2	CH2	720	define geometry of	Optional
CABLE-H3	CH3	730	prestressing strands.	Optional
CABLE-P1	CP1	740		Optional
CABLE-P2	CP2	750		Optional
CABLE-PC1	CB1	760	Use as required to	Optional
CABLE-PC2	CB2	770	define geometry of	Optional
CABLE-PC3	CB3	780	prestressing strands.	Optional
CABLE-DUP	DUP	810		Optional
DEBOND	DBD	820		Optional
TRANSFER ǂ	XFR	823		Optional
PS-BEAM-OVERHANG	PBO	824		Optional
PS-BEAM-SHEAR	PBS	826		Optional
DEAD-LOAD	DLD	830		Required
LOAD-DESCR	LDE	840		Optional
UNIFORM-DL1	UL1	850		Optional
POINT-DL	PTD	860		Optional
TEMP-SETL	TSL	870		Optional
LIVE-LOAD	LLD	880		Required
TRUCK-WFR	TRW	900		Optional
TRUCK-IMP	TRI	910		Optional
TRUCK-CODE1	TR1	920	One or more required	Optional
TRUCK-CODE2	TR2	930	to define live load of	Optional
SPECIAL-TRUCK	STR	940	parameter 6 of Live	Optional
SPECIAL-LANE	SLN	950	Load command is blank.	Optional
AXLE-WF	AWF	960		Optional
DESIGN	DES	980		Required
INVENTORY	INV	990	One or more required	Optional
OPERATING	OPG	1000	for rating.	Optional
POSTING	PST	1010		Optional
SAFE-LOAD	SLD	1020		Optional
POINT-OF-INTEREST	POI	1025		Optional
PRESTRESS-1	PR1	1170	One set for each	Required
PRESTRESS-2	PR2	1180	point to be rated.	Optional
END	END	28		Optional

♯ Due to space constraints, no dialog screens are available in the Graphical User Interface.

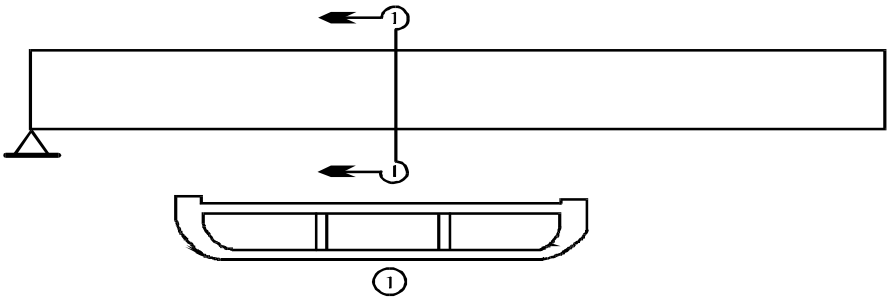
✶ These commands may be placed anywhere in the input data set.

♦ SPAN-COPY may be used in lieu of SPAN-A through SPAN-D commands. See provisions on page 10.30.

ǂ The HINGE and TRANSFER commands may be used to specify additional special analysis points (node points).

♠ These commands are used only when a LFD rating is desired and when the schedule-based option is selected. Due to space constraints, no dialog screens are available in the Graphical User Interface.

11. Sample span, box girder rating.



COMMAND	ABBR	COMMAND NUMBER		USAGE
AGENCY ♯	AGY	1		Optional
BRIDGE-NAME ♯	BRN	2		Optional
LOCATION ♯	LOC	3		Optional
ENGINEER ♯	ENG	4		Optional
TITLE	TLE	10		Required
COMMENT *	COM	20		Optional
INCLUDE *	INC	25		Optional
ANALYSIS	ANL	310		Required
XSECT-A	XSA	350	Repeat as required	Required
XSECT-B	XSB	360	to describe section.	Required
XSECT-G	XSG	410		Required
STIRRUP-GROUP ♠	SIG	428		Optional
SPAN-A	SPA	460		Required
SPAN-C	SPC	480		Required
STIRRUP-SCHEDULE ♠	SIS	497		Optional
FIXITY	FIX	500		Required
HINGE ♯	HNG	520		Optional
PROPERTIES-PC1	PC1	580		Required
PROPERTIES-PC2	PC2	590		Required
PROPERTIES-PC3	PC3	600	Required when prestress	Optional
PROPERTIES-PC4	PC4	610	losses to be calculated	Optional
PROPERTIES-PC5	PC5	620	by PCI general method	Optional
STRAND-ST1	ST1	630		Required
STRAND-ST2	ST2	640	One set required for	Optional
STRAND-ST3	ST3	650	such type of	Optional
STRAND-ST4	ST4	660	prestressing strand.	Optional
POST-TENSION1	PT1	670		Optional
POST-TENSION2	PT2	680		Optional
CABLE-S1	CS1	690		Optional
CABLE-S2	CS2	700		Optional
CABLE-H1	CH1	710	Use as required to	Optional
CABLE-H2	CH2	720	define geometry of	Optional
CABLE-H3	CH3	730	prestressing strands.	Optional
CABLE-P1	CP1	740		Optional
CABLE-P2	CP2	750		Optional

COMMAND	ABBR	COMMAND NUMBER		USAGE
CABLE-PC1	CB1	760		Optional
CABLE-PC2	CB2	770		Optional
CABLE-PC3	CB3	780		Optional
CABLE-DUPDUP	810		Optional	
DEBOND	DBD	820		Optional
TRANSFER ǂ	XFR	823		Optional
DEAD-LOAD	DLD	830		Required
LOAD-DESCR	LDE	840		Optional
UNIFORM-DL1	UL1	850		Optional
POINT-DL PTD	860		Optional	
TEMP-SETL	TSL	870		Optional
LIVE-LOAD	LLD	880		Required
TRUCK-WFR	TRW	900		Optional
TRUCK-IMP	TRI	910		Optional
TRUCK-CODE1	TR1	920	One or more required	Optional
TRUCK-CODE2	TR2	930	to define live load if	Optional
SPECIAL-TRUCK	STR	940	parameter 6 of Live	Optional
SPECIAL-LANE	SLN	950	Load command is blank	Optional
AXLE-WF	AWF	960		Optional
DESIGN	DES	980		Required
INVENTORY	INV	990	One or more required	Optional
OPERATING	OPG	1000	for rating.	Optional
POSTING	PST	1010		Optional
SAFE-LOAD	SLD	1020		Optional
POINT-OF-INTEREST	POI	1025		Optional
PRESTRESS-1	PR1	1170	One set for each point	Required
PRESTRESS-2	PR2	1180	to be rated.	Optional
END	END	28		Optional

♯ Due to space constraints, no dialog screens are available in the Graphical User Interface.

✶ These commands may be placed anywhere in the input data set.

ǂ The HINGE and TRANSFER commands may be used to specify additional special analysis points (node points).

♠ These commands are used only when a LFD rating is desired and when the schedule-based option is selected. Due to space constraints, no dialog screens are available in the Graphical User Interface.

5. PAGE HEADER AND COMMENTS

The commands in this section define a header to be used on each page of output and optional comments used in the command set to help the user document the input.

1	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	AGENCY	AGY
PURPOSE	Use to define the name of the agency or company that is running BRASS. This name appears on the BRASS output page headers. This command is optional.	

1 COMMAND PARAMETER

Agency Name Default = "Wyoming Department of Transportation, Bridge Design Division"	Enter the name of the agency or company that is running BRASS. Up to 60 characters may be used.

EXAMPLE

AGENCY GLANDT AND WATTERS ENGINEERS INC.

FIGURES

NOTES

2	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	BRIDGE-NAME	BRN
PURPOSE	The BRIDGE-NAME command may be used to document the bridge number and short description of the feature intersected. This command is optional.	

2 COMMAND PARAMETERS	
Structure Number	Enter the bridge code or NBI structure number. Up to 15 characters may be used.
Feature Intersected	Enter a short description of the feature intersected. Up to 60 characters may be used.

EXAMPLE

```
BRIDGE-NAME   5353NWI95, BRIDGE OVER SKUNK CREEK
```

FIGURES

NOTES

3	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	LOCATION	LOC
PURPOSE	This command is used to define the bridge's location by milepost (or kilometer post) and route. This command is optional.	
2 COMMAND PARAMETERS		
Milepost or Kilometer Post	Enter the milepost (or kilometer post) where the bridge is located.	
Route Name	Enter the route name where the bridge is located. Up to 60 characters may be used.	

EXAMPLE

LOCATION 90.870, U.S. 14 CODY TO YELLOWSTONE PARK

FIGURES

NOTES

4	BRASS-GIRDER™	COMMAND DESCRIPTION	
COMMAND NAME		**ENGINEER**	**ENG**
PURPOSE		This command is used to define the name of the engineer that is running the program. This command is optional.	
1 COMMAND PARAMETER			
Engineer		Enter the name of the engineer that is running the program. Up to 60 characters may be used.	

EXAMPLE

ENGINEER JANE DOE P.E., BRIDGE ENGINEER

FIGURES

NOTES

10	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	TITLE	TLE
PURPOSE	The data entered by this command is used to identify the output to the user. Agency name, page number and date are included as page heading. This command is required.	
1 COMMAND PARAMETER		
	One or two TITLE commands may be used and each can have up to 60 characters of information. TITLE commands must be the first in the sequence of input commands.	

EXAMPLE

TITLE FOUR SPAN CONCRETE T-GIRDER BRIDGE OVER CRAZY WOMAN CREEK.

TITLE STATION 392+05 1-19-95.

FIGURES

NOTES

20	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	COMMENT	COM
PURPOSE	The COMMENT command may be used to document the string of input commands. They may be inserted in any number in any location in the input after the TITLE command(s).	
	1 COMMAND PARAMETER	
	One or more may be inserted as needed and each may contain up to 60 characters of descriptive data.	

EXAMPLE

```
COMMENT    INPUT SPAN DATA FOR SPANS 1-3.  USE PARABOLIC DEPTH
COMMENT    VARIATION.

COMMENT     DEAD LOAD TO GIRDER ON FOLLOWING DEAD-LOAD
COMMENT     COMMAND.

COMMENT     INCLUDES DECK, CURBS, RAIL AND WEARING SURFACE.
```

FIGURES

NOTES

25	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	INCLUDE	INC
PURPOSE	This command is used to insert one or more BRASS-GIRDER™ commands contained in a data file.	
1 COMMAND PARAMETER		
Included file name	Enter the name of the file to be included. If this file resides in a different directory then the executable program, the full path of the file must be given.	

EXAMPLE

PROPERTIES-ST1	490.000, 29000.0, 3.750, 20.00, 12.000000
DEAD-LOAD	1, 1.0448, , ,
COMMENT	Use INCLUDE file lloads.dat to define live loads.
INCLUDE	c:\bgirder\exe\lloads.dat Note: If the file lloads.dat is in the same directory as your data set(s), the full path does not need to be defined.

FIGURES

NOTES

INCLUDE commands can also be nested inside included files. BRASS-GIRDER™ reads the file until the INCLUDE command is encountered. The INCLUDE file is then opened and read sequentially until the end of the file is reached. BRASS then refers control back to the calling file and continues reading at the command following the INCLUDE command. This command can be used to separate structure data from applied live loads, analysis method, and applied load factors. This is important for routing purposes where the same permit vehicle is run across several structures.

28	BRASS-GIRDER™	COMMAND DESCRIPTION	
COMMAND NAME		**END**	**END**
PURPOSE		This command is used to separate multiple input data sets within a single Command File. This command is not used when only one structure is described. This command may not be used with any of the commands in Chapter 15 (Library Maintenance).	
0 COMMAND PARAMETERS			

EXAMPLE

```
TITLE      BRIDGE OVER CRAZY WOMAN CREEK  I-25  KP  567.232 EBL
ANALYSIS 1, 0, 4
•
•
•
•
•
STEEL-1  205
END
TITLE      BRIDGE OVER CRAZY WOMAN CREEK  I-25  KP  568.489 WBL
ANALYSIS 1, 0, 4
•
•
•
•
•
STEEL-1   205
```

FIGURES

NOTES

This command must be placed at the end of a set of commands describing a single structure.

6. SYSTEM AIDES

The following three commands are basically for assisting the Systems Analyst. However, they are available to the Engineer who desires to further comprehend the internal logic, equations and flow paths utilized in BRASS-GIRDER™.

30	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	SYSTEM-1	SY1
PURPOSE	This command is used to obtain additional information from a run of BRASS. If used, the SYSTEM-1 command should follow the TITLE command. This command is optional.	

6 COMMAND PARAMETERS

Additional User Output	This parameter controls the level of possible additional output that may be useful to the user. Except for prestressed girders, three levels of additional output are available, with level 3 producing the most output. Each level contains all of the output of the lower levels. A description of the levels (ITRACE) available for prestress rating follows: Note: For the analysis or rating of a prestressed girder, three levels of additional output are available for each of the following categories: rating computations, cable path generation, prestress loads generation, and prestress loss computation. Level 1 - Includes all output from levels 2, 5, and 8. Level 2 - A report of the data used for rating and the intermediate results, including: section properties, loads, allowable stresses and actual stresses (working stress), moment capacity (load factors). Level 3 - Level 2 plus a report of the intermediate results of the ultimate loss computations. Level 4 - Level 3 plus more detailed output of the ultimate moment capacity computations. Level 5 - A report of the input strand properties and data defining geometry of the strands. Level 6 - Level 5 plus a report of the strand area, location, and stresses plus a report of the friction loss computations. Level 7 - Level 6 plus more detailed output of the intermediate results of the friction loss computations. Level 8 - A report of the loads applied to the structure due to the change in prestress force.
(Continued)	

COMMAND PARAMETERS (Cont.)	
	Level 9 - Level 8 plus a report of the intermediate results of the computation of the prestress loads. Level 10 - Level 9 plus more detailed output of the computation of the prestress loads. Levels 11 through 19 may be used to request additional output during the computation of prestress losses. BRASS 5 will calculate prestress losses according to either AASHTO I-9.16.2.1 or the PCI General Method. Levels 11, 12, or 13 may be used to request additional output from the AASHTO method or Stage 1 computations of the PCI General Method. Levels 14, 15, or 16 may be used to request additional output from Stage 2 of the PCI General Method and Levels 17, 18, or 19 may be used to request additional output from Stage 3 of the PCI General Method.

Level	Use for construction stage	
11, 12, or 13	1	(or AASHTO Method)
14, 15, or 16	2	
17, 18 or 19	3	

Level 12 - Adds a detailed report of the intermediate results of the loss computations for node points 1 and 2, row 1 and a table summarizing the losses for all rows and node points.

Level 17 - A report of the data used to calculate the prestress losses.

Level 19 - Adds a detailed report of the intermediate results of the loss computations for all node points and rows. (This level should be used only for debugging as excessive output is generated).

Level 20 - Map of prestressed loads due to losses across elements.

NOTE: For the design of reinforced concrete girders, three levels of output are available in each run as described below:

Preliminary Run
Level 1 - Will give additional data relating to minimum and maximum reinforcing and will output fatigue stresses.

Level 2 - Level 1 plus output on shear stresses, distribution of flexure reinforcement requirements and will note if any compression reinforcement is outside compression zone.

Level 3 - Levels 1 & 2 plus more detailed output.

(Continued)

COMMAND PARAMETERS (Cont.)	
	Final Run Level 1 - Will give additional output including that related to inflection points and fatigue. Level 2 - Level 1 plus more output including more information related to fatigue, intermediate cutoff locations and shear stresses. Level 3 - Levels 1 & 2 plus more detailed output.
Program Path	If this parameter is coded 1, the name of each subroutine called during the execution of the program will be printed on the right side of the output when the subroutine is called. The subroutine number and the component number in which it resides will also be printed. If this parameter is coded 2, only the subroutine names of those subroutines called for in the SYSTEM-2 and SYSTEM-3 commands are listed.
Minimum Output	**NOTE: Parameters 3, 4 and 5 below apply only to prestress design.** Normal execution of the prestress design program will produce several reports which are not needed until later stages of design. See page 14.71 for further explanation. In the earlier stages of design, these reports may be suppressed by coding 1.
Minimum output only when overstress	Code 1 to suppress the reports described above only when overstressing occurs.
Detailed output of stirrup spacing	Normal execution of the prestress design program will print a summary of stirrup spacing computed by 1979 Interim and by Article 9.20.2 - 1983 AASHTO specifications. If you want output of detailed computations of Article 9.20.2, Code 1.
Output a summary report of prestress losses. Default = 0	Code 1 to output a summary report of prestress losses when calculated by the AASHTO method.

EXAMPLE

```
SYSTEM-1    2,        1
```

This example calls for Level Two of additional output of interest to the user and turns on the trace of all subroutines called.

FIGURES

NOTES

40	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	SYSTEM-2	SY2
PURPOSE	This command turns on traces of intermediate values from one or more BRASS components. The command may be repeated if more than 6 components are to be traced. This command is optional.	

6 COMMAND PARAMETERS	
First Component Number	Enter the number of the BRASS Component to be traced.
Second Component Number	Enter the number of the BRASS Component to be traced.
Third Component Number	Enter the number of the BRASS Component to be traced.
Fourth Component Number	Enter the number of the BRASS Component to be traced.
Fifth Component Number	Enter the number of the BRASS Component to be traced.
Sixth Component Number	Enter the number of the BRASS Component to be traced.

EXAMPLE

SYSTEM-2 3, 5

The above will turn on a trace of components #3 and #5.

#3 is Deck Analysis.

#5 is Bridge Geometry.

FIGURES

NOTES

50	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	SYSTEM-3	SY3
PURPOSE	This command turns on traces of intermediate values from one or more subroutines. The command may be repeated if more than 6 subroutines are to be traced. This command is optional.	

6 COMMAND PARAMETERS	
First Subroutine	Enter the number of the BRASS subroutine to be traced.
Second Subroutine	Enter the number of the BRASS subroutine to be traced.
Third Subroutine	Enter the number of the BRASS subroutine to be traced.
Forth Subroutine	Enter the number of the BRASS subroutine to be traced.
Fifth Subroutine	Enter the number of the BRASS subroutine to be traced.
Sixth Subroutine	Enter the number of the BRASS subroutine to be traced.

EXAMPLE

```
SYSTEM-3  33,      34,     41
```

The above will turn on a trace of subroutines MESHDS, MESHGN, and PRGEN.

FIGURES

NOTES

7. BRIDGE DECK ANALYSIS

This component calculates stresses and load rating factors for concrete or timber bridge sections. The required reinforcing steel area may be determined for a concrete deck by the working stress method. Load rating factors can be calculated either by the strength or working stress design method.

The commands for this component, if used, must be executed prior to the commands for executing girder analysis. This allows the bridge deck rating factors to be compared with girder ratings for determination of the controlling ratings.

The weight of curbs and/or median are calculated and placed on the deck based on the dimensions input and unit weight of the material. In addition the weight of railing, barriers, overlays, etc., may be considered. The weight of a wearing surface may also be entered. The plan dimensions of the wearing surface may be defined by the curbs and median, or by the user.

Live load moments due to truck wheel loads are calculated in accordance with Article 3.24.3, AASHTO Standard Specifications for Highway Bridges. With the wheel load placed one foot from the curb, these moments include cantilever moments IAW Article 3.24.5. Wheel loads are input by the user.

Maximum moments and shears are calculated for the deck analysis.

The dead load reactions to the girders may be applied as the longitudinal dead load per foot for girder analysis.

The user may differentiate the various load stages by using a stage code. The result will be coordinated with the staging of loads for girder analysis.

60	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECK-CON	DCN
PURPOSE	DECK-CON is the control command for bridge deck analysis. It is required whenever a bridge deck is analyzed. Parameters one and three are the only parameters applicable for timber decks.	

6 COMMAND PARAMETERS

Analysis Control	Code 1: Concrete design by the working strength method is desired. BRASS will determine the area of reinforcement required for a one foot wide strip of transverse concrete deck. Code 2: Rating of either a concrete or a timber deck is desired. This is the only valid code for timber decks. Code 3: Distribution of the dead load of the deck and its appurtenances to the supporting girders is desired. This is only valid for concrete decks. No deck rating is performed. See Note 1
Analysis Girder Concrete decks only. If timber deck, leave blank. (Continued)	Code girder number for which dead load reaction will be applied. See Note 2. The reaction at this girder due to a 1' wide strip of deck and its appurtenances will be applied to the analysis girder as a continuous uniform load on top spans. To obtain girder number, count from left to right. Leave Blank: No dead load reaction due to the deck and its appurtenances is applied to the analysis girder. Use parameters on the DEAD-LOAD command to input loads. Code 0: The maximum reaction at any girder due to the deck and its appurtenances will be applied to the analysis girder as a continuous uniform load on top spans. Note: Code blank if the deck is a part of the girder as in the case of a reinforced concrete T-girder.

COMMAND PARAMETERS (Cont.)	
Continuity Default = 2	If the deck is continuous over 3 or more girders, code 2 . If simple span supported by two girders, code 1.
Girder type Default = 1	* Not required for timber decks. Code 1: Steel or prestressed I-beams supporting girders. Code 2: Concrete supporting girders.
Analysis Type Default = 1	Code 1: Working strength analysis. Code 2: Ultimate strength analysis. (Use default for timber decks (working stress analysis only.)
Intermediate Output Control Default = 0	1 = Intermediate output for dead load distribution methods Tributary Area, Transverse Simple Beam, & Uniformity Distribution to all girders. See Note 1. 2 = Intermediate output for concrete service load design. 3 = Intermediate output for deck analysis and moment distribution.

EXAMPLE

Refer to Figure 1:

DECK-CON 3, 3, , 1, ,
The first blank will default to 2 and the second blank will default to 1.

Refer to Figure 2:

DECK-CON 2

FIGURES

See Examples Above

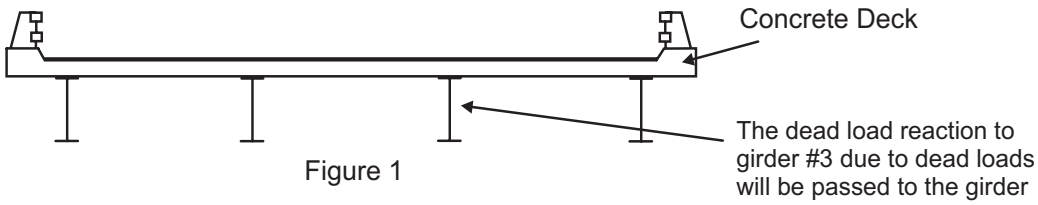


Figure 1

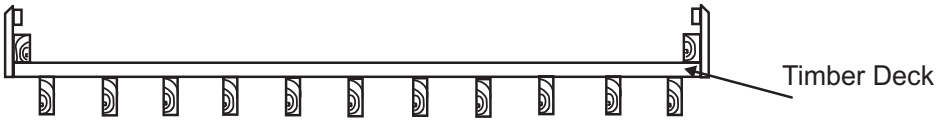


Figure 2

NOTES

3. The primary use of option 3 is to obtain the reactions to each girder supporting the deck. These could be used for pier or abutment design. Therefore, no reinforcing steel data (DECKC-BARA command) or live load data (DECK-TRK1 & 2 commands) are input.

Distribution of the dead load to the supporting girders is normally accomplished using moment distribution. If a deck rating is NOT to be performed and the user wishes to distribute the loads using Tributary Area, Transverse Simple Beam, or Uniformly Distributed to all girders, use the DIST-CONTROL-DL command.

2. If Analysis Control (parameter 1) is coded a '2' (rating of the deck), the method of distributing deck dead loads to the girders will be by moment distribution only. The DIST-CONTROL-DL command may not be used.

65	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DIST-CONTROL-DL	DCD
PURPOSE	Use to control the method of distributing deck dead loads to the girders. This command is required if the deck loads are to be distributed to the bridge and a deck rating will not be performed.	
3COMMAND PARAMETERS		
Stage 1 Method Default = TCB	Enter a code to indicate the method to use to distribute deck loads in Stage 1 to the girder of interest. TA = Tributary area TSB = Transverse simple-beam TCB = Transverse continuous beam (Moment Distribution) See Notes	
Stage 2 Method Default = TCB	Enter a code to indicate the method to use to distribute deck loads in Stage 2 to the girder of interest. TA = Tributary area TSB = Transverse simple-beam UD = Uniformly distributed to all girders TCB = Transverse continuous beam (Moment Distribution) See Notes	
Stage 3 Method Default = TCB	Enter a code to indicate the mthod to use to distribute deck loads in Stage 3 to the girder of interest. TA = Tributary area TSB = Transverse simple-beam UD = Uniformly distributed to all girders TCB = Transverse continuous beam (Moment Distribution) See Notes	

EXAMPLE

To distribute deck dead loads to the girder of interest using the transverse simple-beam method for stage 1, code as follows:

```
DIST-CONTROL-DL TSB
```

FIGURES

NOTES

Transverse continuous beam method assumes prismatic properties based on the gross deck section. Non-prismatic effects such as haunches are not considered in the analysis.

70	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-STG	DSG
PURPOSE	This command controls appurtenances (curb, rail, etc.) loading to the analysis girder when modeling a structure constructed in stages. This command is optional and can only be used when the "Analysis Girder", parameter -2- of the DECK-CON command is non-blank.	

4 COMMAND PARAMETERS

Slab stage Default = 1	Code the construction stage when the uniform load per foot due to the weight of the deck is to be applied to the analysis girder. Only 1, 2, or 3 is a valid stage.
Curb stage Default = 1	Code the construction stage when the uniform load per foot due to the weight of the curbs is to be applied to the analysis girder. Only 0, 1, 2, or 3 is valid.
Median stage Default = 1	Code the construction stage when the uniform load per foot due to the weight of the median is to be applied to the analysis girder. Only 0, 1, 2, or 3 is valid.
Wearing surface stage Default = 1	Code the construction stage when the uniform load per foot due to the weight of the wearing surface is to be applied to the analysis girder. Only 0, 1, 2, or 3 is valid. Note: Code 0 to specify that the load does not exist.

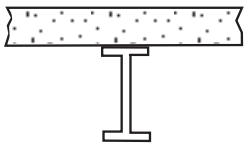
EXAMPLE

In many cases this command will not be required as the structure will be constructed in one stage.

The following example is for a composite steel and concrete bridge where the deck is poured in stage 1 (non-composite section supports the load) and the curbs and wearing surface are placed in the second stage (after the deck concrete has hardened and the girder act compositely).

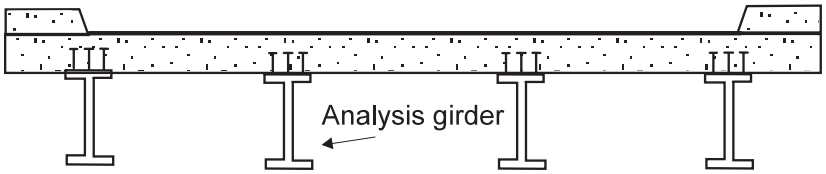
DECKC-STG , 2, 0, 2
The first blank defaults to 1.

FIGURES



Stage 1

Non-hardened concrete deck supported by non-composite beam section



Stage 2

The distributed load to the analysis girder due to the curbs and wearing surface is supported by the composite steel and hardened concrete beam section.

NOTES

80	BRASS-GIRDER™	COMMAND DESCRIPTION

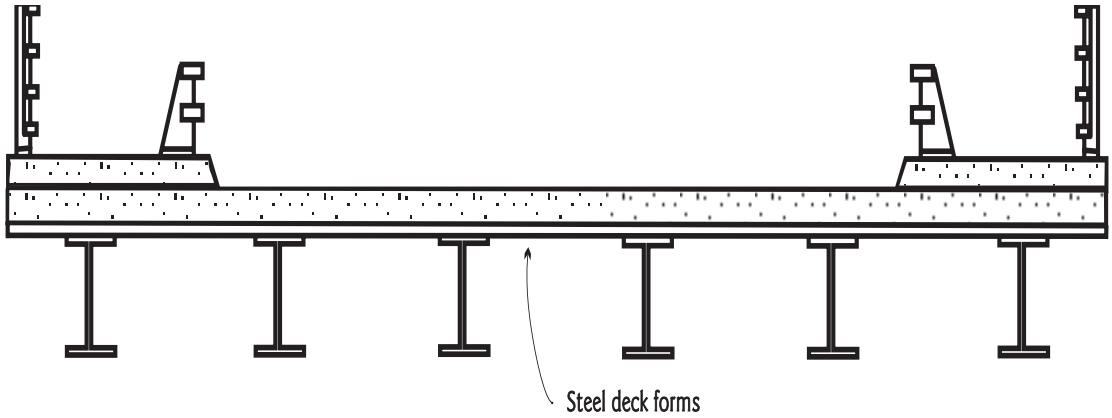
COMMAND NAME	DECKC-COM	DCM
PURPOSE	This command controls the loads used in analyzing a concrete bridge deck independent of the combination of distributed loads to be carried by the analysis girder. It might be used when steel deck forms are left in place. This command is optional and only has meaning if the "Analysis Girder", parameter -2- of the DECK-CON command is non-blank.	
3 COMMAND PARAMETERS		
Omit stage 1 loads	Code 1 if stage one loads are to be omitted from the deck analysis but will still be distributed and applied to the analysis girder.	
Omit stage 2 loads	Code 1 if stage two loads are to be omitted from the deck analysis but will still be distributed and applied to the analysis girder.	
Omit stage 3 loads	Code 1 if stage three loads are to be omitted from the deck analysis but will still be distributed and applied to the analysis girder.	

EXAMPLE

Suppose the engineer does not want the weight of the concrete deck to be carried by the deck as a stage 1 load as this weight is supported by steel deck forms. There is also a sidewalk section placed in stage 2 which the engineer does not want applied for the deck analysis desired. See Figure.

DECKC-COM 1,1

FIGURES



NOTES

90	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-MAT	DMT
PURPOSE	This command captures the materials factors for the concrete in the structural portion of the deck. This command may be omitted if the default values are desired, otherwise it is required for all concrete decks.	

3 COMMAND PARAMETERS

f'_C Default = 4.000 Ksi	Enter the 28 day compressive strength of the concrete, f'_C in kips/sq in.
f_y Default = 60.000 Ksi	Enter the yield stress of the reinforcing steel used in the bridge deck in kips/sq in.
n Default = 8	Enter the modular ratio of steel to concrete for the bridge deck.

EXAMPLE

```
DECKC-MAT   3.250,    40,    10
```

FIGURES

NOTES

100	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-STR1	DS1
PURPOSE	This command controls the percent of allowable stress used in working stress analysis or the load factors to be applied for ultimate strength analysis. This applies to the concrete and reinforcement used in the bridge deck and is required for design or inventory and operating ratings of a concrete deck unless the default values are acceptable. Each parameter has two meanings as described below.	

4 COMMAND PARAMETERS	
f_S, Inventory Default = 0.4 (Working Stress) or γ, Inventory Default = 1.3 (Load Factor)	Enter the decimal fraction of the yield strength of the reinforcing steel used in the bridge deck, f_S, to be used for design or inventory rating by the working strength analysis method. Enter the load factor, γ (see AASHTO 3.22) to be used for inventory rating.
f'_C, Inventory Default = 0.4 (Working Stress) or β_L, Inventory Default = 1.67 (Load Factor)	Enter the decimal fraction of the 28 day compressive strength of the deck concrete, f'_C, to be used for design or inventory rating by the working strength analysis method. Enter the coefficient for live load, β_L to be used for inventory rating. See Notes.
f_S, Operating Default = 0.6 (Working Stress) or γ, Operating Default = 1.3 (Load Factor)	Enter the decimal fraction of the yield strength of the deck reinforcing steel, f_S, used for the determination of the operating rating of the deck. Enter the load factor, γ (see AASHTO 3.22) to be used for operating rating.
f'_C, Operating Default = 0.55 (Working Stress) or β_L, Operating Default = 1.0 (Load Factor)	Enter the decimal fraction of the 28 day compressive strength of the deck concrete, f'_C, to be used for the determination of the operating rating of the deck. Enter the coefficient for live load, β_L to be used for operating rating. See Notes.

EXAMPLE

For a bridge deck constructed of concrete having a 28 day compressive strength of 3250 psi and reinforced with steel deformed bars having a yield strength of 40000 psi, if the following is used:

DECKC-STR1 0.35, 0.3, 0.45, 0.5,

BRASS performs a design or inventory rating analysis based on 0.35 x 40000 = 14000 psi and 0.3 x 3250 = 975 psi for resteel and concrete allowable stresses. It will perform an operating rating analysis based on 0.45 x 40000 = 18000 psi and 0.5 x 3250 = 1625 psi for reinforcing steel and concrete allowable stresses.

FIGURES

NOTES

In accordance with the AASHTO Manual for Condition Evaluation of Bridges, Article 6.5.3, and Standard Specifications for Highway Bridges, Article 3.22, BRASS sets $A_1 = \gamma * \beta_D$ and $A_2 = \gamma * \beta_L$.

110	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-STR2	DS2
PURPOSE	This command controls the percent of allowable stress used in working stress analysis or the load factors to be applied for ultimate strength analysis. This applies to the concrete and reinforcing steel used in the bridge deck and is required for the Posting and Safe Load ratings (working stress analysis) or ultimate strength analysis ratings of a concrete deck. Each parameter has two meanings as described below.	

4 COMMAND PARAMETERS	
f'_S, Posting (Working Stress) or γ, Posting (Load Factor)	Enter the decimal fraction of the yield strength of the deck reinforcing steel to be used for the determination of the posting rating of the deck. Enter the load factor, γ (see AASHTO 3.22) to be used for posting rating.
f'_C, Posting (Working Stress) or β_L, Posting (Load Factor)	Enter the decimal fraction of the 28 day compressive strength of the deck concrete, f'_C, to be used for posting rating by the working strength analysis method. Enter the coefficient for live load, β_L to be used for posting rating. See Notes.
f_S, Safe Load Capacity (Working Stress) or γ, Safe Load Capacity (Load Factor)	Enter the decimal fraction of the yield strength of the deck reinforcing steel, f_S, used for the determination of the safe load capacity rating of the deck. Enter the load factor, γ (see AASHTO 3.22) to be used for safe load capacity rating.
f'_C, Safe Load Capacity (Working Stress) or β_L, Safe Load Capacity (Load Factor)	Enter the decimal fraction of the 28 day compressive strength of the deck concrete, f'_C, to be used for the determination of the safe load capacity rating of the deck. Enter the coefficient for live load, β_L to be used for safe load capacity. See Notes.

EXAMPLE

For a bridge deck constructed of concrete having a 28 day compressive strength of 3250 psi and reinforced with steel deformed bars having a yield strength of 40000 psi, the following is coded:

DECKC-STR2 .55, 0.45, 0.5, 0.4

BRASS performs posting rating analysis based on 0.55 x 40000 = 22000 psi and 0.45 x 3250 = 1463 psi for resteel and concrete allowable stresses. It will perform a safe load capacity rating analysis based on 0.5 x 40000 = 20000 psi and 0.4 x 3250 = 1300 psi for reinforcing steel and concrete allowable stresses.

FIGURES

NOTES

In accordance with the AASHTO Manual for Condition Evaluation of Bridges, Article 6.5.3, and Standard Specifications for Highway Bridges, Article 3.22, BRASS sets $A_1 = \gamma * \beta_D$ and $A_2 = \gamma * \beta_L$.

115	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-STR3	DS3
PURPOSE	This command allows the user to input the value of phi for moment capacity for each rating level. This may be used when requesting the load factor rating of a concrete deck. If this command is omitted, the default values will be used.	

4 COMMAND PARAMETERS	
Phi m (inventory) Default = 0.9	Enter the value of Phi (resistance factor) for moment for inventory rating.
Phi m (operating) Default = 0.9	Enter the value of Phi (resistance factor) for moment for operating rating.
Phi m (posting) Default = 0.9	Enter the value of Phi (resistance factor) for moment for posting rating.
Phi m (safe load) Default = 0.9	Enter the value of Phi (resistance factor) for moment for safe load rating.

EXAMPLE

Suppose that the engineer wants to run a rating using the Load and Resistance Rating method outlined in the AASHTO Guide Specifications for Strength Evaluation of Existing Steel and Concrete Bridges, 1989. Based on Table 3(b), a resistance factor of 0.75 is chosen. Since only one level of rating is used with the method prescribed by this document, the DECKC-STR3 would be coded as follows:

DECKC-STR3 0.75

FIGURES

NOTES

120	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-DIM1	DD1
PURPOSE	This is the first in a series of commands used to describe the dimensions of the cross-section of a concrete bridge deck. It is always required for a concrete deck analysis. A maximum of 50 girders may be entered.	

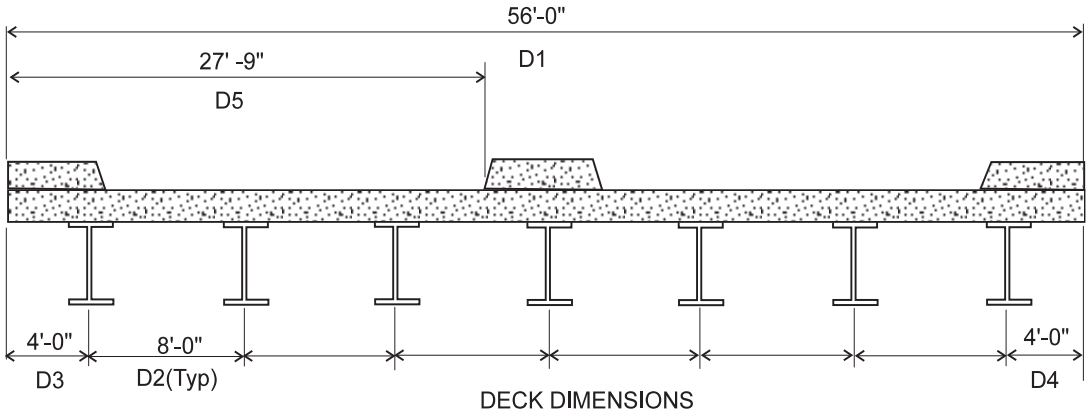
5 COMMAND PARAMETERS	
NG	Enter the number of girders supporting the deck. See Figure.
D2	If the girder spacing is constant enter the center to center distance between girders in feet. If the spacing varies, code 1 and use one or more DECKC-GS commands to describe the spacing. See Figure.
D3 Default = 1/2 girder width (D14 on Page 7.20)	Enter the length of the left cantilever in feet. See Figure and Notes.
D4 Default = D3	Enter the length of the right cantilever in feet. See Figure and Notes.
D5	Enter the distance from the left edge of the deck to the left edge of the median. If no median leave blank.

EXAMPLE

For the deck shown in the Figure below:

DECKC-DIM1 7, 8, 4, , 27.75

FIGURES

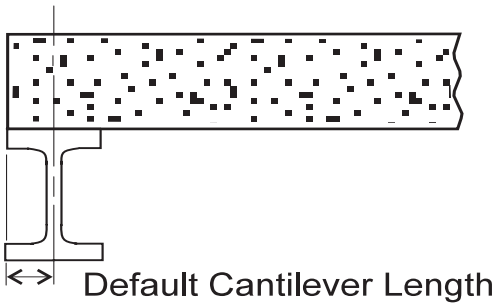


DECK DIMENSIONS

NOTES

Overall deck width is calculated internally.

If left cantilever is not input, its length will be automatically set to 1/2 the girder top width. The right cantilever will default to the left cantilever length.



This length will be used to calculate weight but not actions.

130	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-DIM2	DD2
PURPOSE	This is the second in a series of commands describing the dimensions of the cross-sectional view of a concrete bridge deck. It is required if the concrete deck has curbs or a median.	

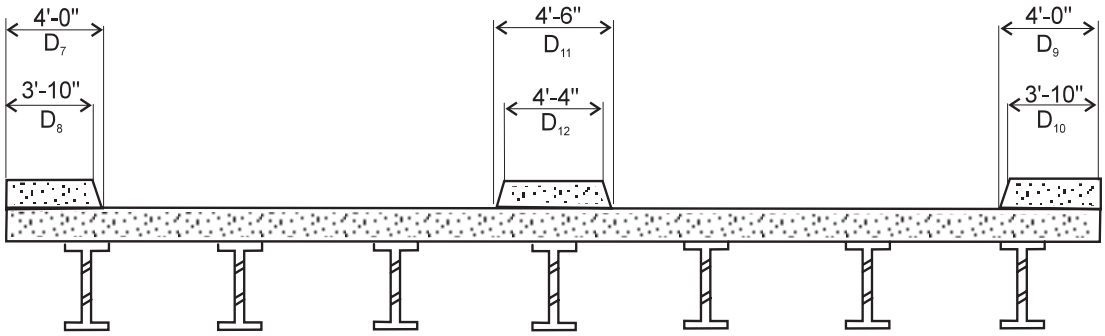
6 COMMAND PARAMETERS	
D7	Enter the width of the bottom of the left curb in feet. See Figure.
D8	Enter the width of the top of the left curb in feet. See Figure.
D9 Default = D7	Enter the width of the bottom of the right curb in feet. See Figure.
D10 Default = D8	Enter the width of the top of the right curb in feet. See Figure.
D11	Enter the width of the bottom of the median in feet. See Figure.
D12	Enter the width of the top of the median in feet. See Figure.

EXAMPLE

For the deck shown in the Figure below:

DECKC-DIM2 4, 3.8333, , , 4.5, 4.3333

FIGURES



DECK DIMENSIONS

NOTES

140	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-DIM3	DD3
PURPOSE	This is the third in a series of commands describing the dimensions of the cross-section of a concrete bridge deck. It is required for concrete bridge deck analysis.	

7 COMMAND PARAMETERS	
T	Enter the thickness of the slab in inches used to determine the moment capacity of the deck section. Generally the total depth of the slab is used unless there is a topping course applied later. See Figure.
D14	Enter the width of the girder in inches where it supports the deck. See Figure. BRASS will calculate all the effective distances based upon girder type.
D15	If there is a supporting soffit at interior girders, enter the distance in feet from the centerline of the girder to the beginning of the taper or if there is no taper enter the distance to the edge of the soffit. See Figure.
D16 Default = D15	If there is a supporting soffit at interior girders, enter the distance in feet from the centerline of the girder to the end of the taper or if there is no taper enter the distance to the edge of the soffit. See Figure.
D17	If there is a supporting soffit, enter the thickness of the soffit in inches. See Figure.
D6	If there are curbs or median, enter the thickness of the curbs and median in inches. See Figure.
D31	Enter the thickness of the top flange, in inches, for steel stringers or prestressed beams. See Figure. If this entry is left blank (such as in old BRASS data sets) the top flange width to thickness ratio will be assumed to be 4.1.

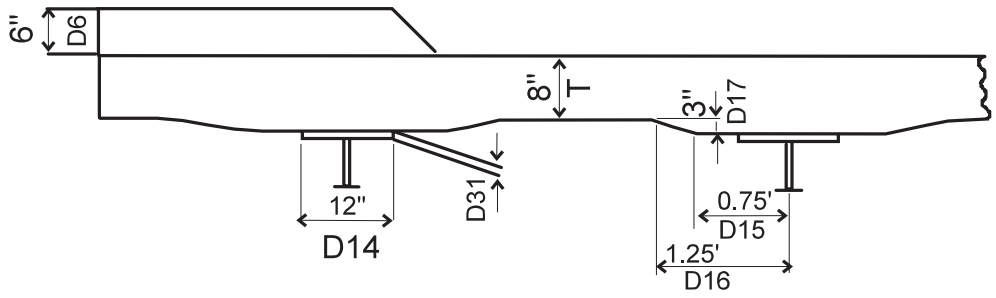
EXAMPLE

For the deck shown in the Figure below:

DECKC-DIM3 8, 12, 0.75, 1.25, 3, 6

FIGURES

Note: BRASS adds thickness of taper to T if the taper is flatter than 45°.



DECK DIMENSIONS

NOTES

Soffits on interior girders are assumed to always be symmetrical about the vertical centerline of the girder.

The dimensions described may also be used to describe fillets on concrete girders.

150	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-DIM4	DD4
PURPOSE	This is the fourth in a series of commands describing the dimensions of the cross sectional view of a concrete bridge deck. It is required if there are soffits above the exterior girders.	

6 COMMAND PARAMETERS

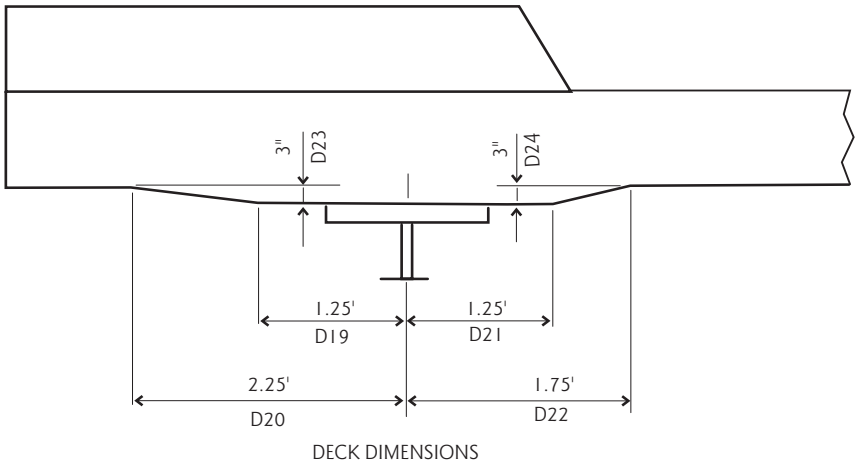
D19	Enter the distance from the centerline of the left exterior girder in feet to the beginning of the left taper or if there is no taper enter the distance to the left edge of the soffit. See Figure.
D20 Default = D19	Enter the distance from the centerline of the left exterior girder in feet to the end of the left taper or if there is no taper enter the distance to the left edge of the soffit. See Figure.
D23	Enter the thickness of the left soffit in inches.
D21 Default = D19	If the soffit is not symmetrical about the centerline of the left exterior girder, enter the distance from the centerline of the left exterior girder to the beginning of the right taper or if there is no taper the distance in feet to the right edge of the soffit. See Figure.
D22 Default = D20	If the soffit is not symmetrical about the centerline of the leftexterior girder, enter the distance from the centerline of the left exterior girder to the end of the right taper or if there is no taper the distance in feet to the right edge of the soffit. See Figure.
D24 Default = D23	Enter the thickness of the right soffit in inches.

EXAMPLE

For the deck shown in the figure below:

DECKC-DIM4 1.25, 2.25, 3, , 1.75

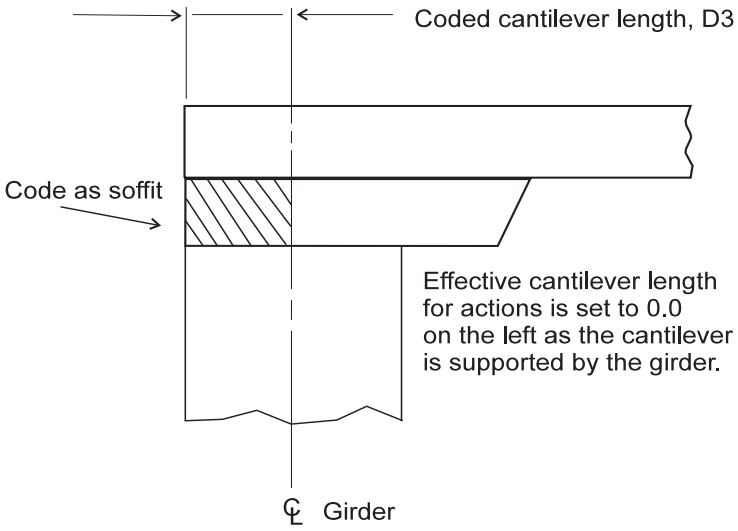
FIGURES



DECK DIMENSIONS

NOTES

If there is a soffit on one side of a girder, there must be one on the opposite side.


Coded cantilever length, D3
Code as soffit
Effective cantilever length
for actions is set to 0.0
on the left as the cantilever
is supported by the girder.
℄ Girder

160	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-DIM5	DD5
PURPOSE	This is the fifth in a series of commands describing the dimensions of the cross section of a concrete bridge deck. It is required if there are tapers on the soffit above the right exterior girder.	

6 COMMAND PARAMETERS

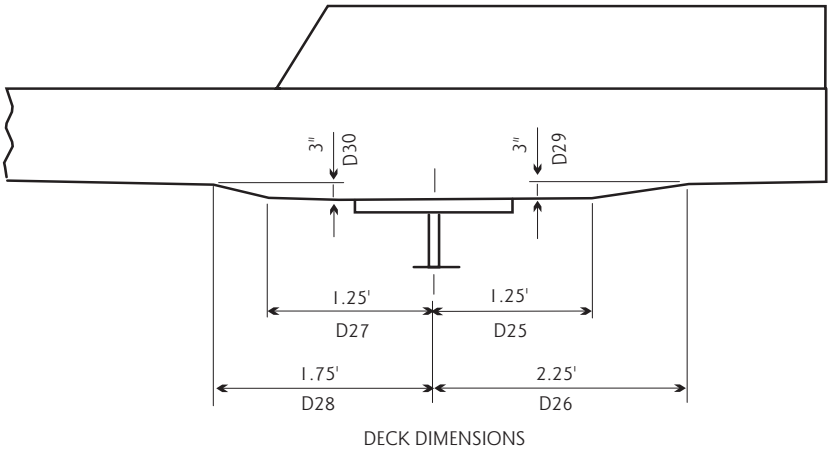
D27	Enter the distance from the centerline of the right exterior girder in feet to the beginning of the left taper or if there is no taper enter the distance to the left edge of the soffit. See Figure.
D28 Default = D27	Enter the distance from the centerline to the right exterior girder in feet to the end of the left taper or if there is no taper enter the distance to the left edge of the soffit. See Figure.
D30	Enter the thickness of the left soffit in inches.
D25 Default = D27	If the soffit is not symmetrical about the centerline of the right exterior girder, enter the distance from the centerline of the right exterior girder to the beginning of the right taper or if there is no taper the distance in feet to the right edge of the soffit. See Figure.
D26 Default = D28	If the soffit is not symmetrical about the centerline of the right exterior girder, enter the distance from the centerline of the right exterior girder to the end of the right taper or if there is no taper the distance in feet to the right edge of the soffit. See Figure.
D29 Default = D30	Enter the thickness of the right soffit in inches.

EXAMPLE

For the deck shown in the figure below:

DECKC-DIM5 1.25, 1.75, 3, , 2.25

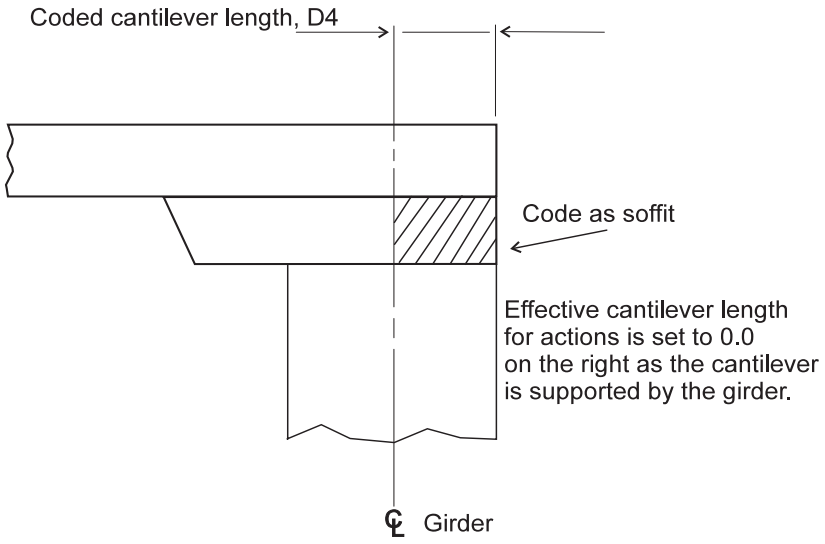
FIGURES



DECK DIMENSIONS

NOTES

If there is a soffit one one side of a girder, there must be one on the opposite side.


Coded cantilever length, D4
Code as soffit
Effective cantilever length
for actions is set to 0.0
on the right as the cantilever
is supported by the girder.
℄ Girder

170	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-GS	DGS
PURPOSE	This command defines the spacing of the girders when the girders are not evenly spaced. This command must be used when the second parameter on the DECKC-DIM1 command is 1. BRASS will analyze a deck supported on as many as 50 girders (49 spaces). If there are more than 6 spaces repeat this command for the additional spaces required.	

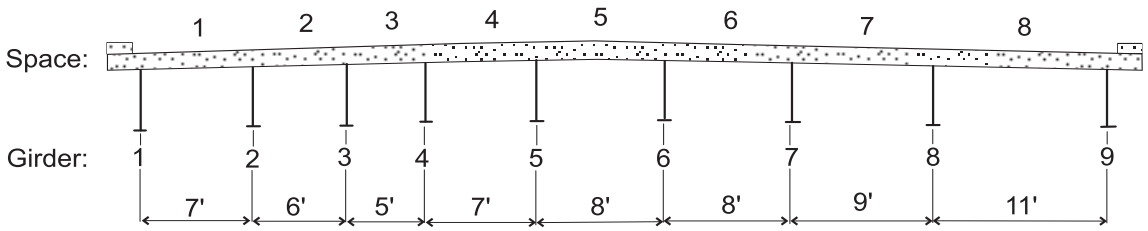
6 COMMAND PARAMETERS	
Space 1 (or Space 7, 13...)	Numbering the supporting girders from left to right, enter the space, in feet, between girders #1 and #2 (or #7 and #8, etc., if a repeat command).
Space 2 (or Space 8, 14...)	Numbering the supporting girders from left to right, enter the space, in feet, between girders #2 and #3 (or #8 and #9, etc., if a repeat command).
Space 3 (or Space 9, 15...)	Numbering the supporting girders from left to right, enter the space, in feet, between girders #3 and #4 (or #9 and #10, etc., if a repeat command).
Space 4 (or Space 10, 16...)	Numbering the supporting girders from left to right, enter the space, in feet, between girders #4 and #5 (or #10 and #11, etc., if a repeat command).
Space 5 (or Space 11, 17...)	Numbering the supporting girders from left to right, enter the space, in feet, between girders #5 and #6 (or #11 and #12, etc., if a repeat command).
Space 6 (or Space 11, 18...)	Numbering the supporting girders from left to right, enter the space, in feet, between girders #6 and #7 (or #12 and #13, etc., if a repeat command).

EXAMPLE

For the figure shown below:

DECKC-GS 7, 6, 5, 7, 8, 8
DECKC-GS 9, 11

FIGURES



NOTES

180	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-BARA	DBA
PURPOSE	This command defines the reinforcing steel in a concrete bridge deck. There are three possible locations for reinforcing steel in each analysis location (positive moment area, negative moment area, and cantilever). The input is based on a one foot wide analysis strip of the deck. This command is required for the rating or design of a concrete bridge deck. Repeat for each reinforcing steel bar size in the one foot wide strip.	

4 COMMAND PARAMETERS	
Bar Size	Enter the bar size (number) of the reinforcing bar to be described. This command is ignored for a concrete deck design.
Distance from Bottom Inches	Enter the distance in inches from the bottom of the deck to the center of the reinforcing bar. See DIST in Figure.
Spacing Inches	Enter the horizontal distance in inches to the next reinforcing bar of the same size. If the next reinforcing bar of the same size lies outside the one foot wide strip to be analyzed, only enter one bar. See SP in Figure. This command is ignored for a concrete deck design.
Moment Region	Enter the appropriate code describing the moment region in which this reinforcing bar lies. See Figure and notes. This command is ignored for a concrete deck design. 1 Positive moment region B-B 2 Negative moment region C-C 3 Cantilever moment region A-A

EXAMPLE

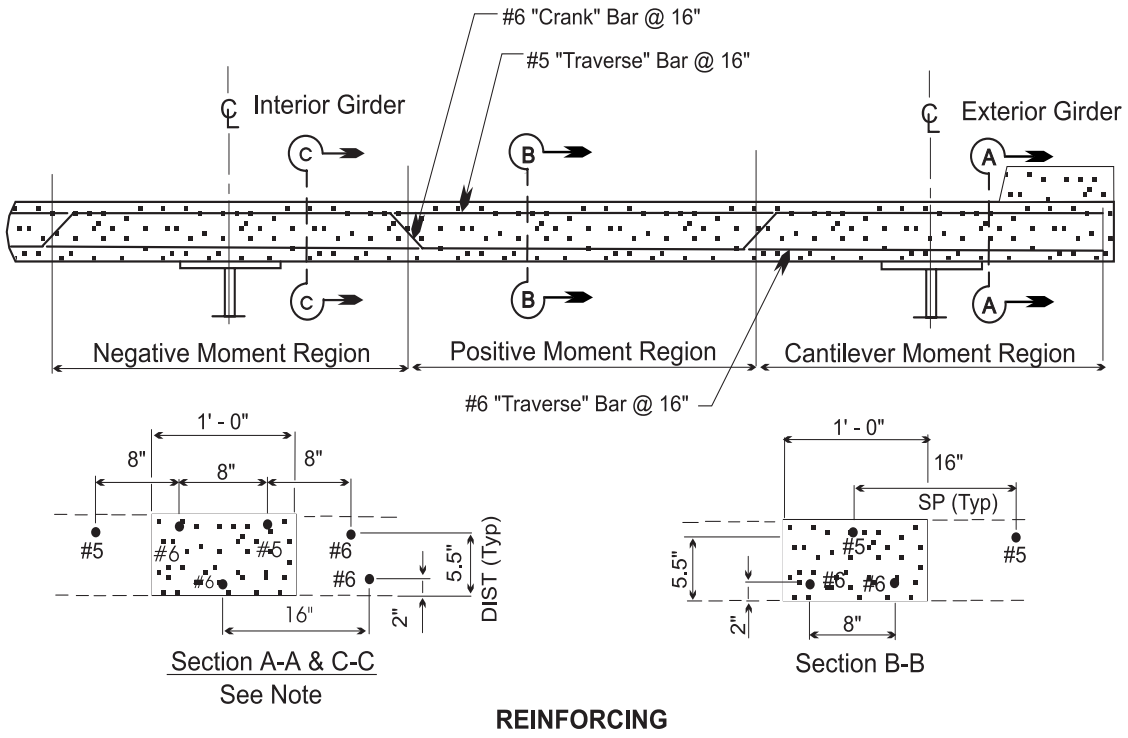
For the Figure shown below:

DECKC-BARA 6, 2, 16, 2
(Compression Steel - Optional)
DECKC-BARA 6, 5.5, 16, 2
(#6 Crank Bar)
DECKC-BARA 5, 5.5, 16, 2
(#5 Transverse Steel - Top of Slab)
DECKC-BARA 6, 2, 8, 1
(#6 Crank Bar and #6 Transverse Steel - Bottom of Slab)
DECKC-BARA 5, 5.5, 16, 1
(Compression Steel - Optional)

Section C-C
(For Section A-A, See Note)

Section B-B

FIGURES



REINFORCING

NOTES

Rebar data for cantilever moment region may be omitted if it is the same as the negative moment region.

190	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-LODG	DLG
PURPOSE	This command defines several of the material parameters and dimensions needed for the program to calculate the dead load of the deck, curbs, median, and wearing surface. This command also controls the placement of wheel loads during live load computations. This command is required for the analysis of concrete decks unless all defaults are used.	

5 COMMAND PARAMETERS

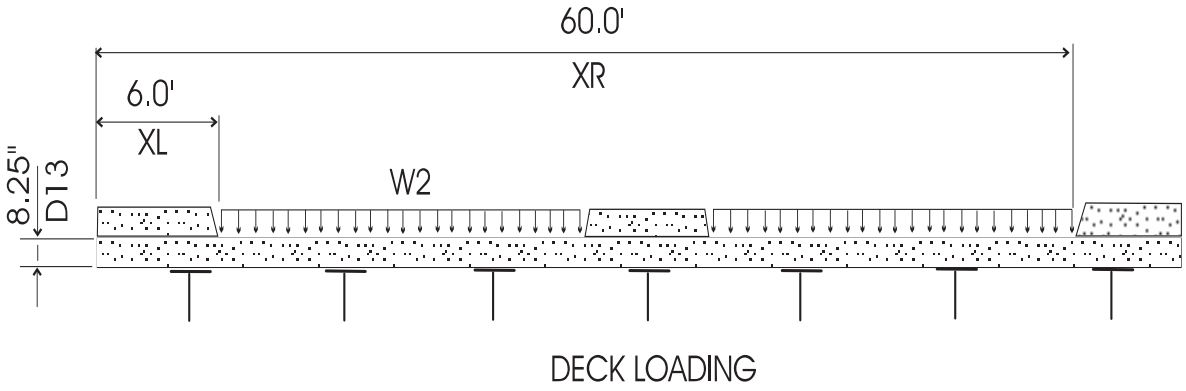
W1 Default = 0.150	Enter the density of the concrete used in the deck, curbs, and median in kips per cubic foot.
W2 Default = 0.018	Enter the weight of one square foot of the wearing surface in kips. See Note 2.
XL Default, left curb edge of the travel way.	Enter the distance in feet from the left edge of the deck to the left edge of the travel way. This distance controls placement of the wheel loads for cantilever actions and the limits of the wearing surface if it exists.
XR Default, right curb defines right edge of travel way.	Enter the distance in feet from the left edge of the deck to the right edge of the travel way. This distance controls placement of the wheel loads for cantilever actions and the limits of the wearing surface if it exists.
D13 Default = T, the first parameter coded on the DECKC-DIM3 command.	Enter the thickness, in inches, of slab to be used in the calculation the slab weight if it is different than the thickness used to determine the deck strength.

EXAMPLE

For the Figure shown below:

DECKC-LODG , 0.018, , , 8.25

FIGURES



DECK LOADING

Density of concrete = 0.150 K/ft^3
Weight of one square foot of wearing surface W2, = 0.018 K

NOTES

1. BRASS will deduct the base area of the median from the area subjected to W2, wearing surface load.

2. BRASS will apply wearing surface as a stage 2 load when the second parameter of the DECK-CON command is non-blank.

200	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-LODC	DLC
PURPOSE	This command allows the user to apply concentrated loads to the bridge deck. This command is optional. It may be repeated as needed to describe up to a maximum of 9 point loads.	

4 COMMAND PARAMETERS

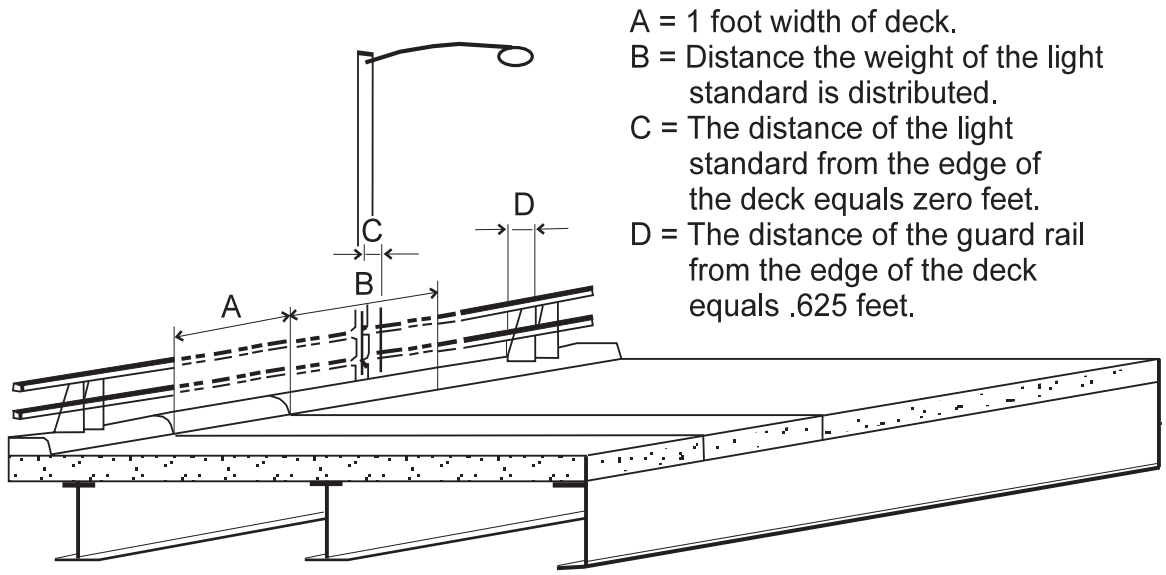
Load Description Code	This parameter causes the effects due to this point load to be labeled in the output with one of the following names. Enter the number opposite the label desired. New Jersey Barrier 1 Traffic Railing 2 Pedestrian Railing 3 Light Standard 4 Utilities 5 Miscellaneous 6
P	Enter the amount of the point load in kips/ft (parallel to girder). See Figure.
XP	Enter the distance if feet from the left edge of the bridge deck to the point of application of the point load. See Figure.
Stage Default = 1	Enter the construction stage in which this point load is to be applied so that it becomes effective on the analysis girder.

EXAMPLE

For the figure shown below:

```
DECKC-LODC    4,   0.0400,    0.0
DECKC-LODC    2,   0.035,     0.625
```

FIGURES


A = 1 foot width of deck.
B = Distance the weight of the light standard is distributed.
C = The distance of the light standard from the edge of the deck equals zero feet.
D = The distance of the guard rail from the edge of the deck equals .625 feet.
A
B
C
D

NOTES

1. The bridge is a non-composite girder slab with a 60 foot span. For analysis, non-composite bridges use only Stage 1 construction. Therefore, the default value of 1 for stage is used.

2. The light standard weighs 1.2 kips and the weight is considered to act over 30 feet. Therefore, the weight per foot equals (1.2/30 = 0.040 kips/ft).

3. The guardrail weighs 0.035 kips/ft and the weight is considered to act over the entire span of 60 feet.

4. The loads used in these examples can be entered using other commands, they are just cited here as examples.

Note: The moment at the base of the light standard due to wind could be entered as a couple of forces at a small distance apart. ↓ ↑

210	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKC-LODU	DLU
PURPOSE	This command allows the user to apply uniform loads to the bridge deck. The wearing surface, the weight of the deck itself, curbs and median are calculated internally. This command is optional. It may be repeated as needed to describe up to a maximum of 9 different uniform loads.	

5 COMMAND PARAMETERS

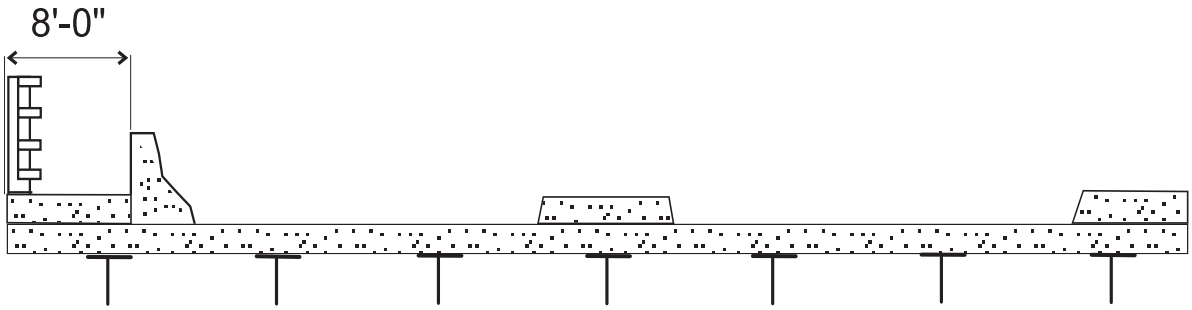
Load Description Code	The parameter causes the effects due to this uniform load to be labeled in the output with one of the following names. Enter the number corresponding to the label desired. Concrete topping (non-wearing surface) 1 Asphalt topping (non-wearing surface) 2 Sidewalk (not defined by curb dimensions) 3 Miscellaneous 4
W	Enter the uniform load in kips/sq. ft.
XW	Enter the distance in feet from the left edge of the deck to the beginning of the uniform load.
XWI	Enter the width in feet of the uniform load.
Stage Default = 1	Enter the construction stage in which this uniform load is to be applied so that it becomes effective on the analysis girder.

EXAMPLE

For the Figure shown below:

DECKC-LODU 3, 0.05, 0, 8.0, 1

FIGURES



NOTES

220	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKT-G1	DG1
PURPOSE	This command defines general data related to timber bridge decks. It is required for rating of timber decks	

6 COMMAND PARAMETERS

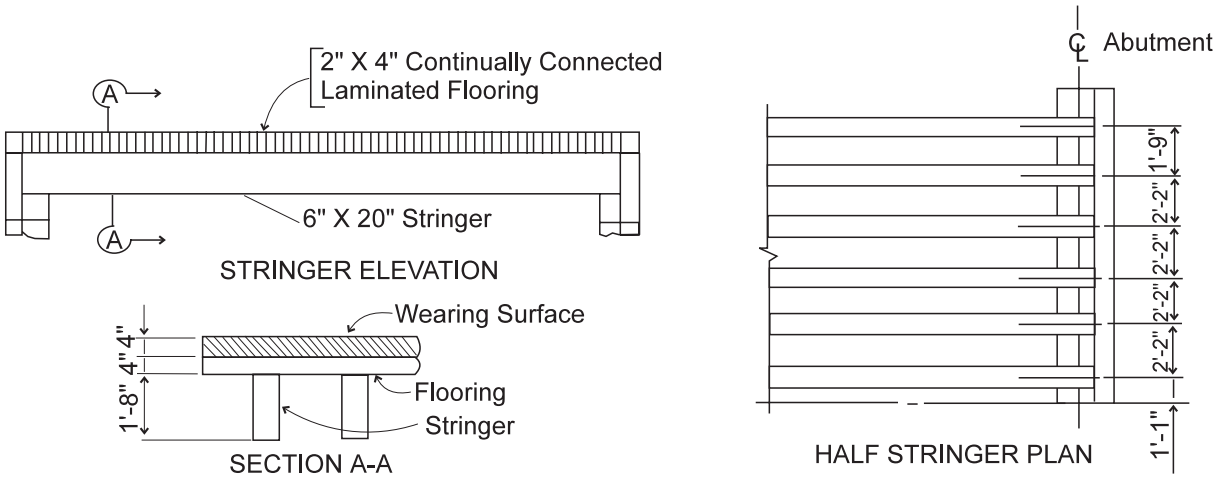
Spacing	Enter the distance in feet centerline to centerline between the stringers supporting the timber deck. See Figure.
Stringer Width	Enter the width in inches of the supporting stringers. See Figure.
P-Width Default = 12	Enter the width in inches of the flooring member. This could be either the width of a plank or a laminated panel. For continuous laminated (no panels) leave this parameter blank.
P-Depth Default = 3	Enter the depth (thickness) in inches of the flooring member. This could be either the thickness of a plank or the thickness of a laminated panel.
WDECK Default = 50	Enter the weight in pounds of a cubic foot of the decking material.
WSURF Default = 18	Enter the weight in pounds of a square foot of the wearing surface material resting on the timber deck.

EXAMPLE

For the Figure shown below and a material weight of 60 lbs/cu.ft.

DECKT-G1 2.1667, 5, , 4, 60, 43.33

FIGURES



TREATED TIMBER BRIDGE DECK

NOTES

230	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKT-G2	DG2
PURPOSE	This command defines general data related to timber bridge decks. It is required for rating of timber decks.	

5 COMMAND PARAMETERS

Inventory Bending Default = 2100	Enter the allowable bending stress in pounds per square inch for calculating the inventory rating of the deck.
Inventory Shear Default = 95	Enter the allowable shear stress in pounds per square inch for calculating the inventory rating of the deck.
Operating Bending Default = 2394	Enter the allowable bending stress in pounds per square inch for calculating the operating rating of the deck.
Operating Shear Default = 126	Enter the allowable shear stress in pounds per square inch for calculating the operating rating of the deck.
Flooring Type Default = 4	Enter the code shown below for the type of flooring (deck). Plank Floor 1 Nail laminated separate panels 2 Glue laminated separate panels 3 Continuous or nail connected 'nail connected panels' 4 Connected glue laminated panels 5

EXAMPLE

For a timber bridge deck constructed of planks of 'Dense Select Structural Douglas Fir - Larch' for which a policy has been adapted of utilizing 1200 psi allowable tension parallel to the grain (bending) for inventory rating determination, 1650 psi for operating rating determination, and 95 psi allowable horizontal shear for inventory rating determination.
Note: Shear does not apply for plank decks.

DECKT-G2 1200, , 1650, , 1

FIGURES

NOTES

Defaults are based on Douglas Fir-Larch, Select Structural (West Coast Lumber Inspection Bureau) 2" x 4" thick and 2" x 4" wide (used at 19% maximum moisture content) for dry conditions. Also based on 2" x 4" laminated decks. These defaults are from the 1989 AASHTO Specifications, with 1991 interims. The defaults were not changed with the newer specifications to allow previous data sets to run without modifications.

240	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKT-G3	DG3
PURPOSE	This command defines allowable stresses for bending and shear for posting rating and safe load capacity rating of timber bridge decks. This command is required when posting and safe load capacity ratings of timber decks are desired.	

4 COMMAND PARAMETERS	
Posting Bending	Enter the allowable bending stress in pounds per square inch for calculating the 'posting' rating of a timber deck.
Posting Shear	Enter the allowable shear stress in pounds per square inch for calculating the 'posting' rating of a timber deck.
Safe Load Capacity Bending	Enter the allowable bending stress in pounds per square inch for calculating the 'safe load capacity' rating of a timber deck.
Safe Load Capacity Shear	Enter the allowable shear stress in pounds per square inch for calculating the ‘safe load capacity’ rating of a timber deck.

EXAMPLE

For a timber bridge deck constructed of planks of 'Dense Select Structural Douglas Fir - Larch' for which a policy has been adapted of utilizing 1425 psi allowable tension parallel to the grain (bending) for posting rating determination, 1420 for safe load capacity rating determination, and 113 psi allowable horizontal shear for 'posting' rating determination, 112 for 'safe load capacity' rating determination.

DECKT-G3 1425, 113, 1420, 112

FIGURES

NOTES

The hypothetical policy used above was based on posting midway between inventory and operating rating and safe load capacity at 65 of inventory rating.

55

See Notes on page 7.39.

250	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKT-LWT1	DL1
PURPOSE	This command defines the wheel load distribution lengths and widths to timber decking for trucks 1, 2, & 3. This command is optional and if not used, BRASS will calculate the wheel length and width based on the type of flooring and criteria in AASHTO 3.3.0 and AASHTO 3.25.1.	

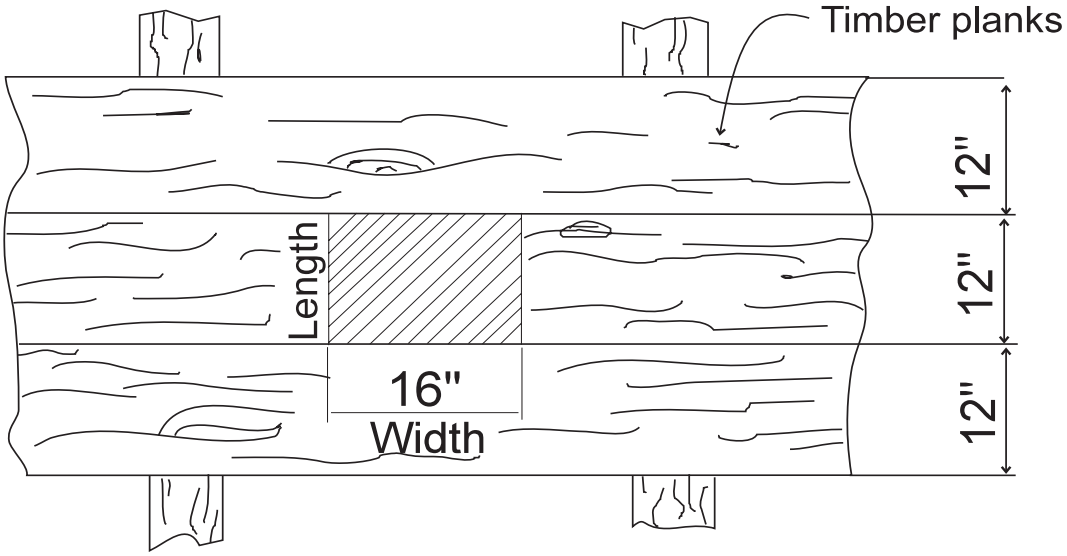
6 COMMAND PARAMETERS	
Truck #1 Length Default = AASHTO 3.30	Enter the length in inches of the wheel load distribution area desired for truck #1. This is the length perpendicular to the flooring. See Figure.
Truck #1 Width Default = AASHTO 3.25.1	Enter the width in inches of the wheel load distribution area desired for truck #1. This is the width parallel to the flooring.
Truck #2 Length Default = AASHTO 3.30	Enter the length in inches of the wheel load distribution area desired for truck #2. This is the length perpendicular to the flooring. See Figure.
Truck #2 Width Default = AASHTO 3.25.1	Enter the width in inches of the wheel load distribution area desired for truck #2. This is the width parallel to the flooring.
Truck #3 Length Default = AASHTO 3.30	Enter the length in inches of the wheel load distribution area desired for truck #3. This is the length perpendicular to the flooring. See Figure.
Truck #3 Width Default = AASHTO 3.25.1	Enter the width in inches of the wheel load distribution area desired for truck #3. This is the width parallel to the flooring.

EXAMPLE

For the situation shown below in the Figure the engineer wants to distribute the wheel load over a width of 16 inches and use the length of the load distribution equal to the plank width as specified in AASHTO. He wants to use the distribution for trucks 1, 2, and 3.

DECKT-LWT1 , 16, , 16, , 16

FIGURES



NOTES

260	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKT-LWT2	DL2
PURPOSE	This command defines the input wheel load distribution lengths and widths to timber decking for trucks 4, 5, & 6. This command is optional and if not used, BRASS will calculate the wheel length and width based on the type of flooring and criteria in AASHTO 3.30 and AASHTO 3.25.1.	

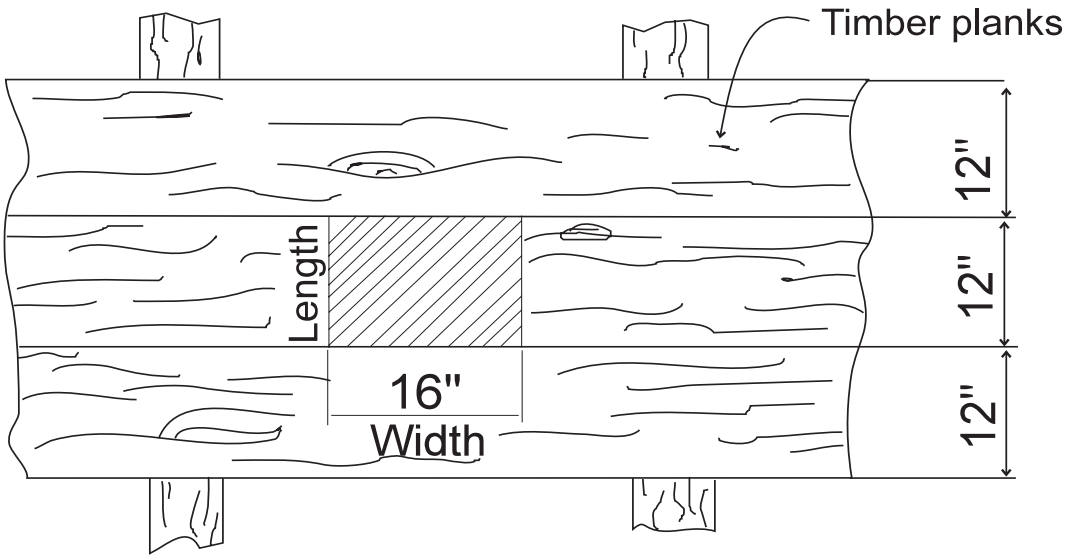
6 COMMAND PARAMETERS	
Truck #4 Length Default = AASHTO 3.30	Enter the length in inches of the wheel load distribution area desired for truck #4. This is the length perpendicular to the flooring. See Figure.
Truck #4 Width Default = AASHTO 3.25.1	Enter the width in inches of the wheel load distribution area desired for truck #4. This is the width parallel to the flooring.
Truck #5 Length Default = AASHTO 3.30	Enter the length in inches of the wheel load distribution area desired for truck #5. This is the length perpendicular to the flooring. See Figure.
Truck #5 Width Default = AASHTO 3.25.1	Enter the width in inches of the wheel load distribution area desired for truck #5. This is the width parallel to the flooring.
Truck #6 Length Default = AASHTO 3.30	Enter the length in inches of the wheel load distribution area desired for truck #6. This is the length perpendicular to the flooring. See Figure.
Truck #6 Width Default = AASHTO 3.25.1	Enter the width in inches of the wheel load distribution area desired for truck #6. This is the width parallel to the flooring.

EXAMPLE

For the situation shown below in the Figure, the engineer wants to distribute the wheel load over a width of 16 inches and use the length of the load distribution equal to the plank width as specified in AASHTO. This distribution is used for trucks 4, 5 and 6.

DECKT-LWT2 , 16, , 16, , 16

FIGURES



NOTES

270	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKT-LWT3	DL3
PURPOSE	This command defines the input wheel load distribution lengths and widths to timber decking for trucks 7, 8, & 9. This command is optional and if not used, BRASS will calculate the wheel length and width based on the type of flooring and criteria in AASHTO 3.30 and AASHTO 3.25.1.	

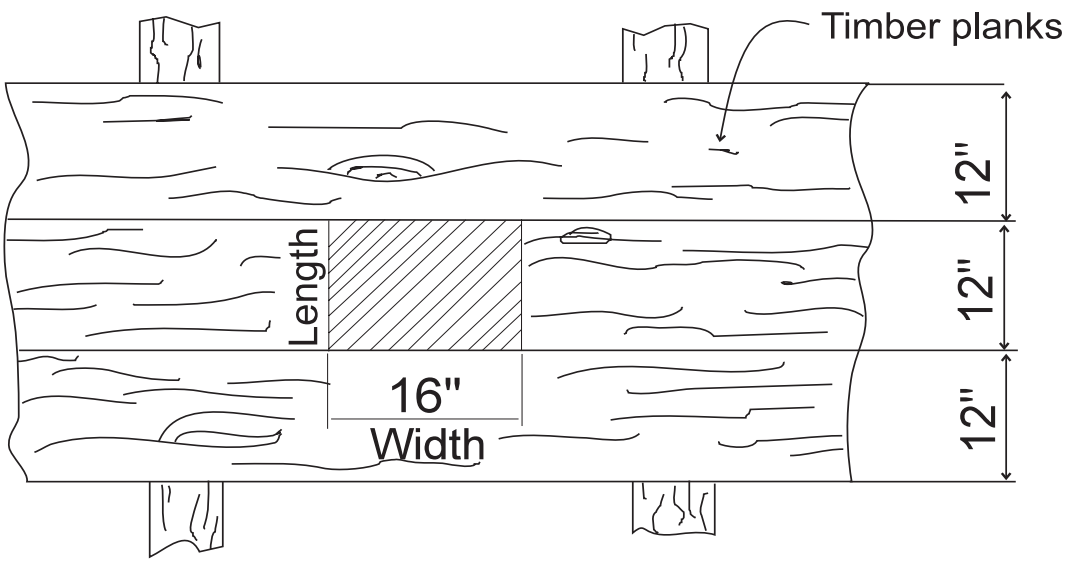
6 COMMAND PARAMETERS	
Truck #7 Length Default = AASHTO 3.30	Enter the length in inches of the wheel load distribution area desired for truck #7. This is the length perpendicular to the flooring. See Figure.
Truck #7 Width Default = AASHTO 3.25.1	Enter the width in inches of the wheel load distribution area desired for truck #7. This is the width parallel to the flooring.
Truck #8 Length Default = AASHTO 3.30	Enter the length in inches of the wheel load distribution area desired for truck #8. This is the length perpendicular to the flooring. See Figure.
Truck #8 Width Default = AASHTO 3.25.1	Enter the width in inches of the wheel load distribution area desired for truck #8. This is the width parallel to the flooring.
Truck #9 Length Default = AASHTO 3.30	Enter the length in inches of the wheel load distribution area desired for truck #9. This is the length perpendicular to the flooring. See Figure.
Truck #9 Width Default = AASHTO 3.25.1	Enter the width in inches of the wheel load distribution area desired for truck #9. This is the width parallel to the flooring.

EXAMPLE

For the situation shown below in the Figure, the engineer wants to distribute the wheel load over a width of 16 inches and use the length of the load distribution equal to the plank width as specified in AASHTO. This distribution is used for trucks 7, 8, & 9.

DECKT-LWT3 , 16, , 16, , 16

FIGURES



NOTES

280	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECKT-LWT4	DL4
PURPOSE	This command defines the input wheel load distribution lengths and widths to timber decking for truck 10. This command is optional and if not used, BRASS will calculate the wheel length and width based on the type of flooring and criteria in AASHTO 3.30 and AASHTO 3.25.1.	

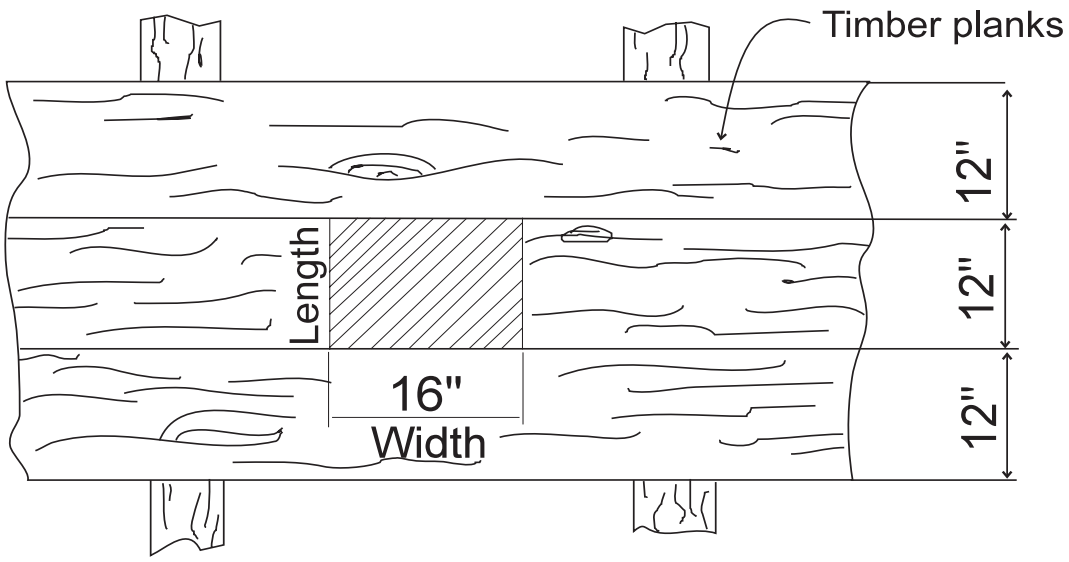
2 COMMAND PARAMETERS	
Truck #10 Length Default = AASHTO 3.30	Enter the length in inches of the wheel load distribution area desired for truck #10. This is the length perpendicular to the flooring. See Figure.
Truck #10 Width Default = AASHTO 3.25.1	Enter the width in inches of the wheel load distribution area desired for truck #10. This is the width parallel to the flooring.

EXAMPLE

For the situation shown below in the Figure, the engineer wants to distribute the wheel load over a width of 16 inches and use the length of the load distribution equal to the plank width as specified in AASHTO. He wants to use this distribution for Truck 10.

DECKT-LWT4 , 16

FIGURES



NOTES

290	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECK-TRK1	DT1
PURPOSE	This command defines wheel loads of trucks 1 through 6 to be applied to either a timber deck or a concrete deck. This command is required for a design or rating of a bridge deck.	

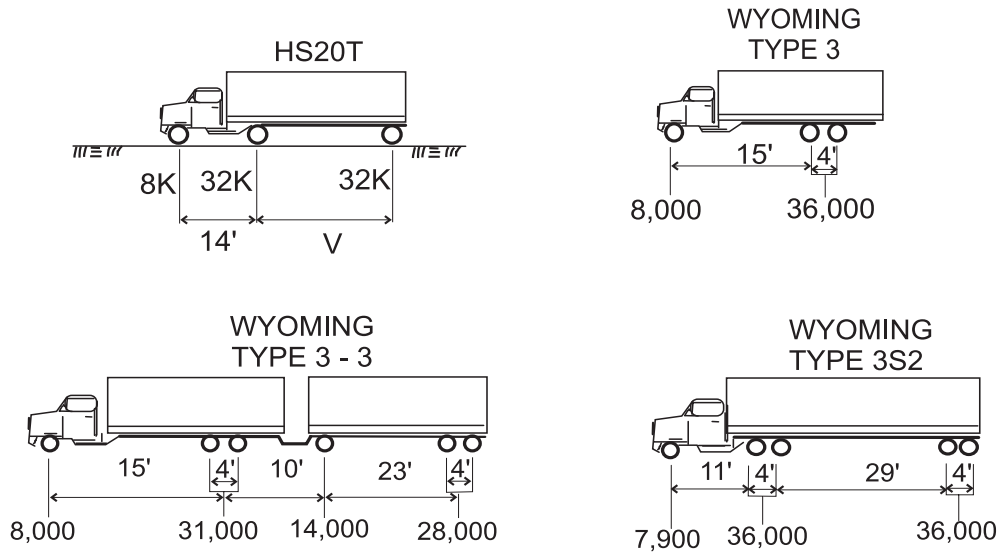
6 COMMAND PARAMETERS	
Truck 1	Enter the weight in kips of the maximum wheel load of truck #1. See Notes.
Truck 2	Enter the weight in kips of the maximum wheel load of truck #2. See Notes.
Truck 3	Enter the weight in kips of the maximum wheel load of truck #3. See Notes.
Truck 4	Enter the weight in kips of the maximum wheel load of truck #4. See Notes.
Truck 5	Enter the weight in kips of the maximum wheel load of truck #5. See Notes.
Truck 6	Enter the weight in kips of the maximum wheel load of truck #6. See Notes.

EXAMPLE

To rate a concrete deck for three trucks (HS20T, Wyoming TYPE3S2, & Wyoming TYPE3-3) and applying the tandem axle option for calculating live load moment (see Note 2 below), the following example would be correct:

```
DECK-TRK1  16,    -9, -7.75
```

FIGURES



NOTES

1. If a girder analysis is desired following a deck analysis, the number of trucks entered here must agree with the number entered in the TRUCK-CODE1 and TRUCK CODE2 Commands. See Notes on page 13.23.

2. The AASHTO Manual for Maintenance Inspection of Bridges, 1983, Section 5.3.3, allowed the engineer to use the following equations to compute the effects of a tandem axle having spans from 2' to 7':

$E = 0.36\ S + 2.58$ (Distribution of a Wheel Load)
$M = + 0.25\ (P/E)S$ (Freely Supported Spans)
$M = 0.2\ (P/E)S$ (Continuous Spans)

For spans over 7', $E = 0.063\ S + 4.65$. To invoke this option, the user would input the wheel load as a negative number (see example above). The 1994 edition of the AASHTO Manual for Maintenance Inspection of Bridges, Section 6.7.2.1, removed this option and states "In general, stresses in the deck do not control the load rating except in special cases. The calculation of bending moments in the deck should be in accordance with AASHTO Design Specifications." If the engineer wants to continue using the 1983 equations, the option to input tandem loads as a negative number will remain available in BRASS. It is the engineer's responsibility to determine the loads from the tandem axle to be entered in this command.

300	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DECK-TRK2	DT2
PURPOSE	This command defines wheel loads of trucks 7 through 10 to be applied to either a timber deck or a concrete deck. It is also used to input the amount of impact. This command is required if there are more than 6 trucks and/or the user wishes to override the impact default.	

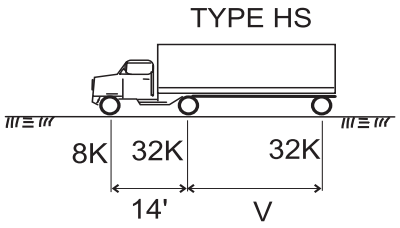
6 COMMAND PARAMETERS	
Truck #7	Enter the weight in kips of the maximum wheel load of truck #7. See Notes.
Truck #8	Enter the weight in kips of the maximum wheel load of truck #8. See Notes.
Truck #9	Enter the weight in kips of the maximum wheel load of truck #9. See Notes.
Truck #10	Enter the weight in kips of the maximum wheel load of truck #10. See Notes.
Span Impact Default = 0.3 for Concrete, 0.0 for Timber.	Enter the live load impact as a decimal fraction that is to be used for the actions in the deck spanning the girders. For 0.0 impact, as in the case of a timber deck, enter 0.0.
Cantilever Impact Default = 0.3 for Concrete, 0.0 for Timber.	Enter the live load impact as a decimal fraction that is to be used for the actions on the cantilever portion of the span. For 0.0 impact, as in the case of a timber deck, enter 0.0.

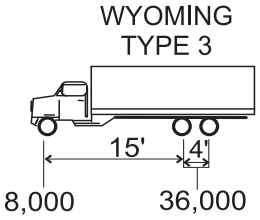
EXAMPLE

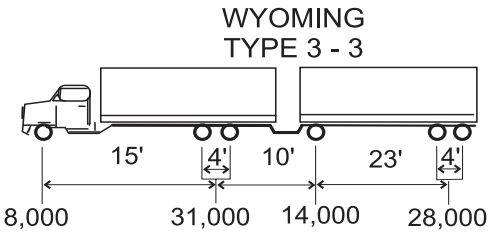
To rate a deck for trucks 7, 8, and 9 which are for this example of HS20T, a Wyoming Type3S2 and a Wyoming Type3-3, and the desired live load impact is 0.2:

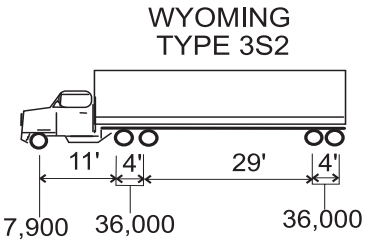
```
DECK-TRK2      16,    9,        7.75,        ,      0.2,   0.2
```

FIGURES









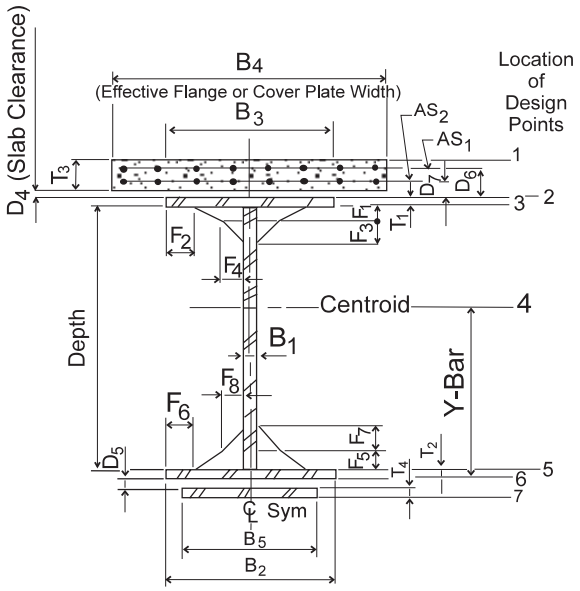
NOTES

If a girder analysis is desired following a deck analysis, the number of trucks entered here must agree with the number entered in the TRUCK-CODE1 and TRUCK-CODE2 Commands. See Notes on page 13.23.

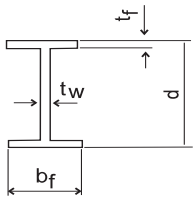
8. GIRDER ANALYSIS

Two specific tasks are required of the user to model a structure through commands to this component:

1. Define girder cross sections along each span or supporting member. This is done by defining each unique cross section in the structure and the ranges along each span where each typical cross section begins and ends. BRASS-GIRDER supports three different methods of describing a typical cross section as shown below. In addition, a cross-section may be circular as in the case of a integral column or be modeled as a floorbeam (see Chapter 13). Cross section dimensional properties may vary uniformly from one typical cross section to the next when the cross section is defined by elements of an I.

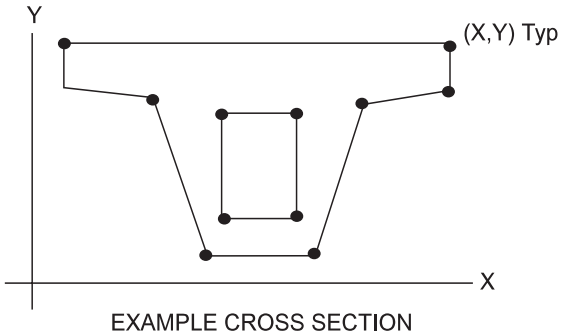


EXAMPLE CROSS SECTION
Defined by Elements of an I



Designation	Area A	Depth d	Flange Width bt	Flange Thickness tf
	In.2	In.	In.	In.
W10 x 112	11.38	10.415	11.248	0.755
x 100	11.12	10.345	1.118	0.685
x 89	10.88	10.275	0.998	0.615

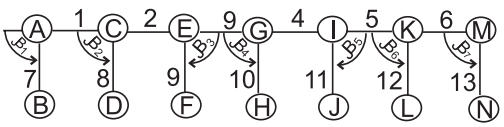
EXAMPLE CROSS SECTION
From Standard Tables



EXAMPLE CROSS SECTION
Defined by X-Y Coordinates of Perimeter Points

Figure 1

2. Input is minimized through selection of spans from the "basic structure", Figure 2, which is also referred to as a cell layout. The "continuous type layout", is to be used when there are more than six continuous spans. Most bridge structures can be modeled using members from this layout.



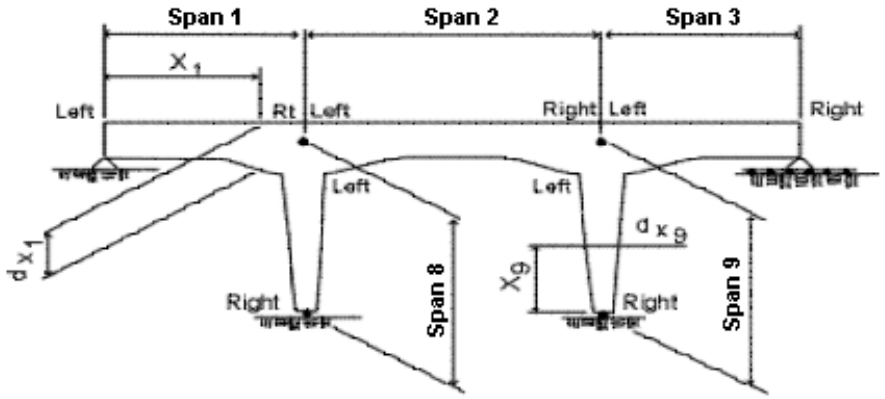
BASIC STRUCTURE

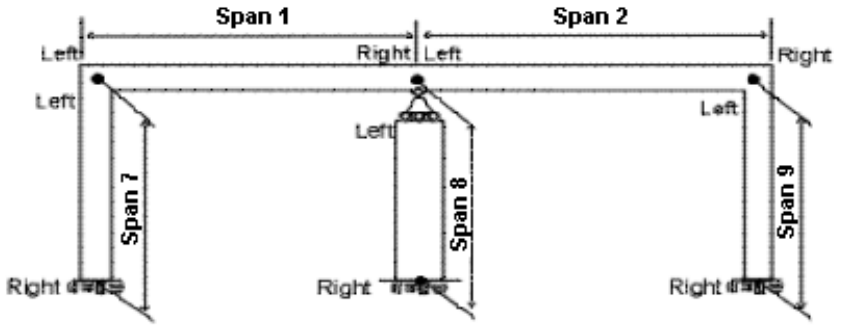
CONTINUOUS TYPE LAYOUT

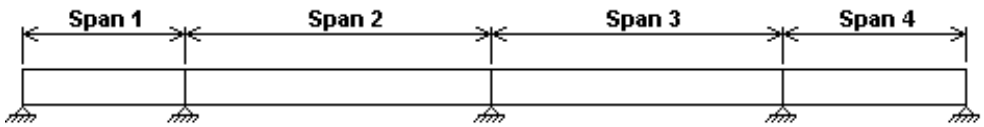
(Use only if you have more than 6 Continuous Spans)

Figure 2

Define the length of each span or supporting member and the depths, d, as a function of position along the member. Illustrated below are variations of the "basic structure" which may be modeled.







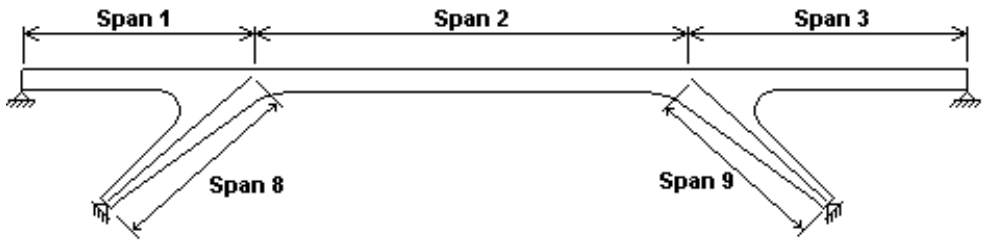


Figure 3

The possible depth variations are shown below and on Page 8.4.

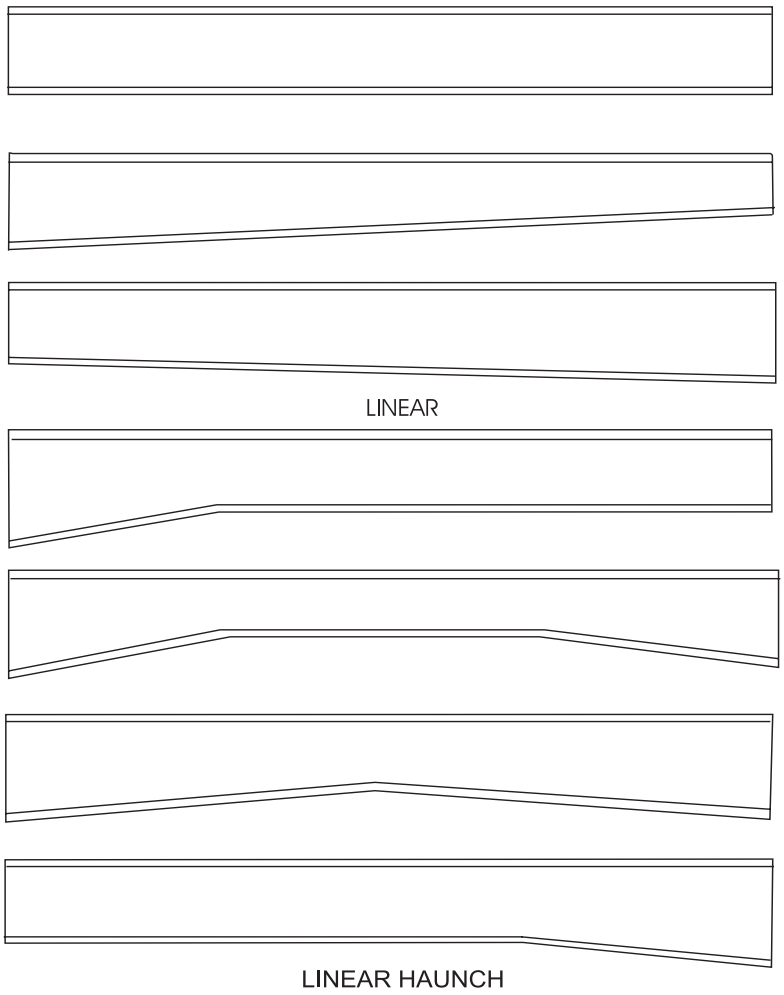
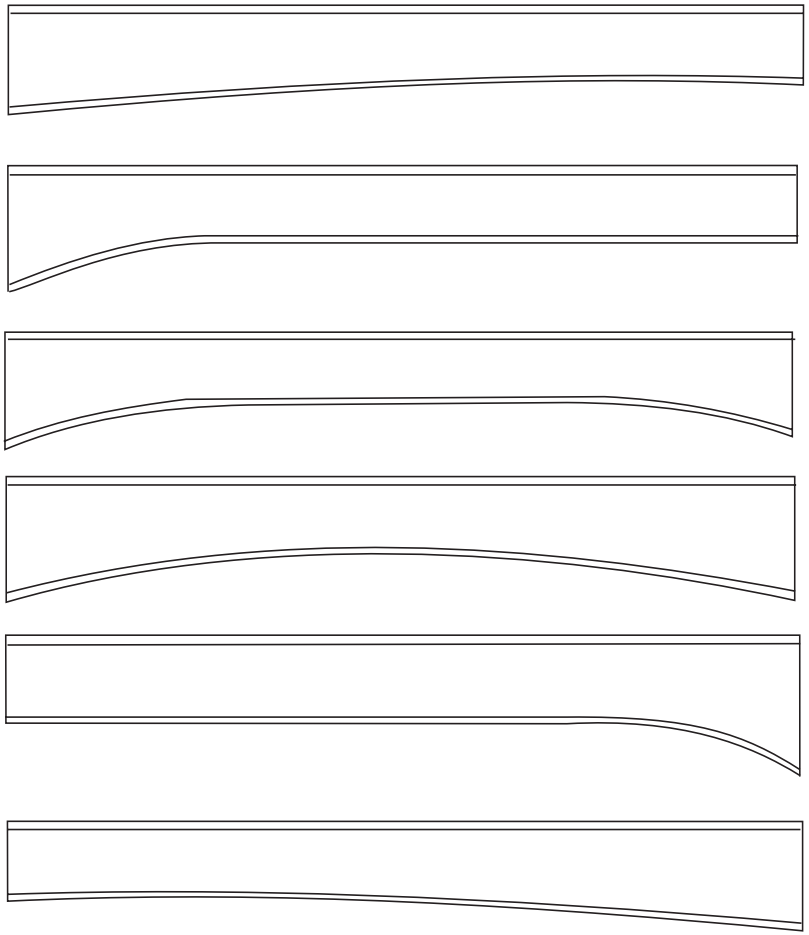


Figure 4 - Web Depth Variation

Ranges and restrictions are:

1. Maximum number of unique cross sections for one structure is one hundred.
2. Maximum number of cross section ranges for any one span is forty.
3. Maximum number of web depths for a span is fifteen.
4. Ranges for web depth are always measured from left to right from the center line of bearing of the span.
5. Span number one of the designer's structure must be the same as span number one of the basic structure.
6. Maximum number of continuous spans is thirteen.
7. Maximum number of cells is six.
8. The left end of vertical (or canted) spans are considered to be at the top.



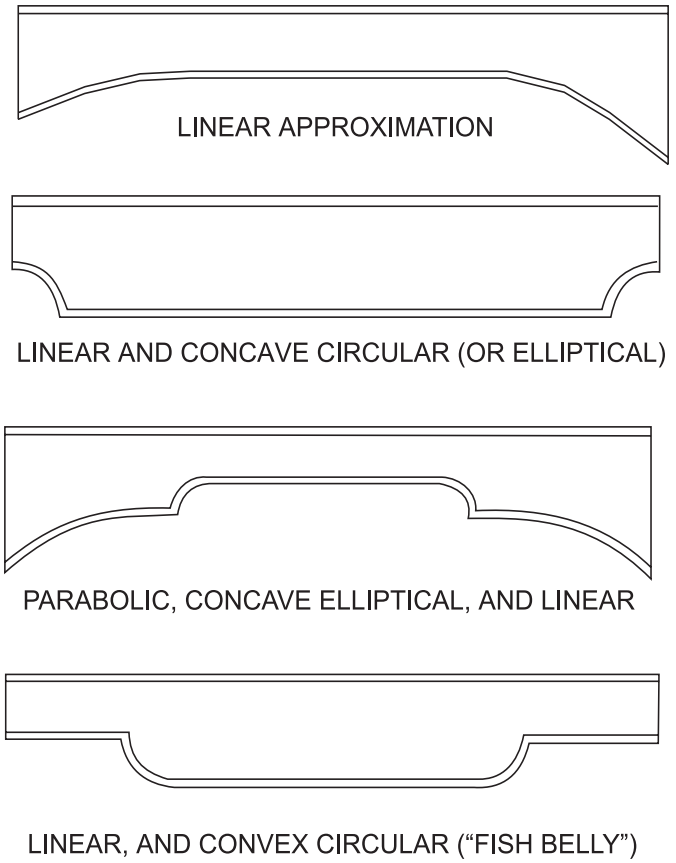

LINEAR APPROXIMATION
LINEAR AND CONCAVE CIRCULAR (OR ELLIPTICAL)
PARABOLIC, CONCAVE ELLIPTICAL, AND LINEAR
LINEAR, AND CONVEX CIRCULAR (“FISH BELLY”)
COMPLEX

Figure 4 (Cont) - Web Depth Variations

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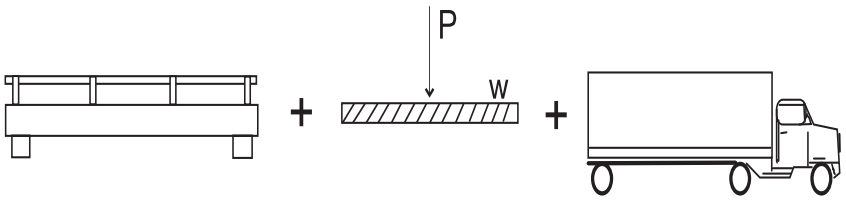
310	BRASS-GIRDER™	COMMAND DESCRIPTION

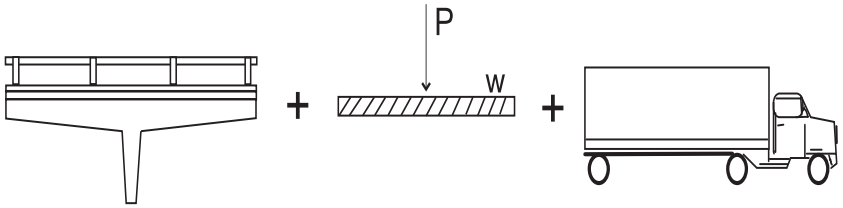
COMMAND NAME	ANALYSIS	ANL
PURPOSE	This is the first command of the "Structural analysis component" and sets control parameters. This command is always required for girder analysis. It must be preceded by either TITLE, COMMENT, or the last command of a bridge deck analysis.	

9 COMMAND PARAMETERS

Output Control	A single digit code to control the printout options of this component. Code 0 will suppress all but minimal output, Code 1 will produce a list of girder properties at each node point on the structure in addition to minimal output. See page 2.11 for more information on output control.
Structure Type Default = 0	Two types of structure types are possible. Code 0 for frame type or less than 7 continuous, or 1 for a non-frame structure with more than 6 continuous spans. See Figure 1, Page 8.13.
Sequence (Type of Structure)	A single digit code to represent the type of construction and the construction sequence or staging to be modeled. This code will set the program path controls for construction stage and type of loads at specific stages. Code Result 1 Timber bridge with one stage. All loads are applied to that stage.



2 Reinforced concrete bridge with one construction stage. All loads are applied to that stage. However, code “21" for a reinforced concrete girder slab bridge to meet the provisions of AASHTO 8.19.1.

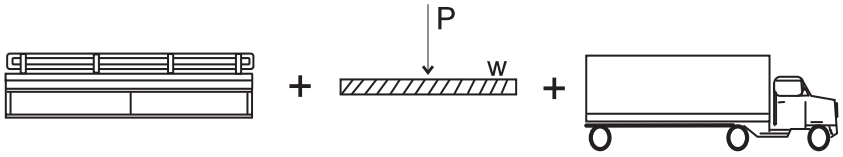


(Continued)

COMMAND PARAMETERS (Cont.)

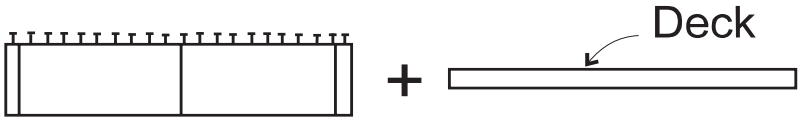
Code Result

3 Non-composite steel girder bridge with one construction stage. All loads are applied to that stage.

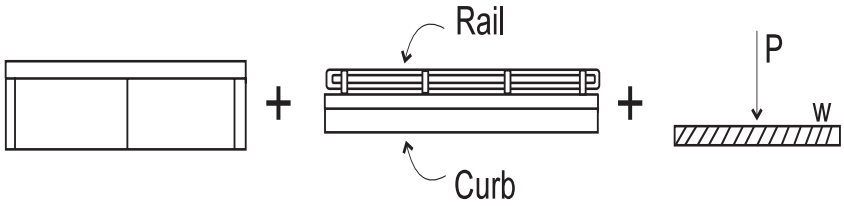


4 Composite steel and concrete with sustained dead load on the composite section. There are three stages modeled in this sequence. First the bridge is modeled as non-composite and all stage 1 loads are applied. Next the bridge is modeled as composite steel and concrete with the modular ratio adjusted to allow for creep, usually 3n, and all stage 2 loads should be sustained loads such as curbing, railing, wearing surface and median where creep would be a factor. The structure is next modeled as a composite steel and concrete with the modular ratio adjusted for creep. Live loads, which are temporary, are then applied to this.

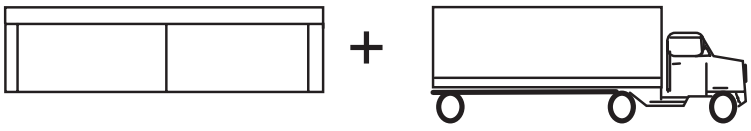
Stage 1



Stage 2



Stage 3



41 Composite steel and concrete box girder. See Note 8.

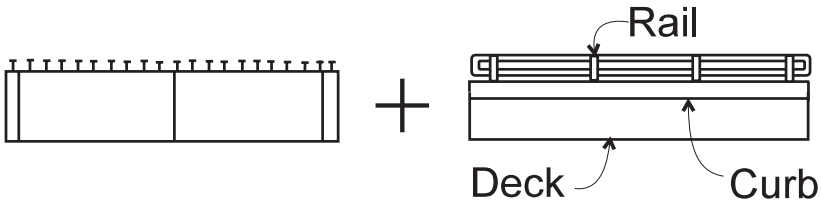
(Continued)

COMMAND PARAMETERS (Cont.)

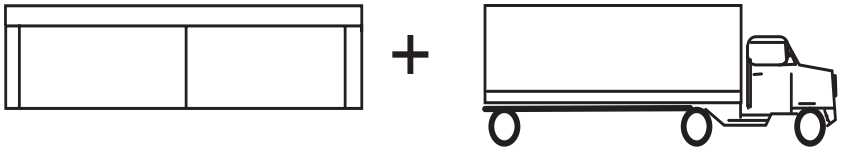
Code Result

5 Composite steel and concrete without sustained dead load on the composite section. There are two stages modeled in this sequence. First the bridge is modeled as non-composite and all stage 1 (dead loads) are applied. Next the bridge is modeled as composite steel and concrete and all live loads are applied.

Stage 1

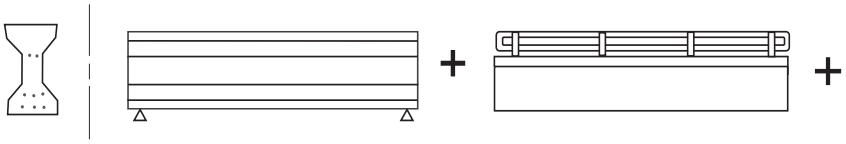


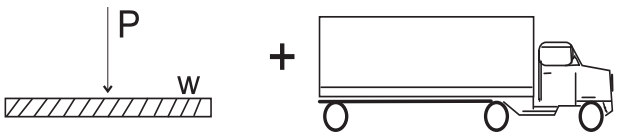
Stage 2



6 Prestressed concrete girders, non-composite. Refer to the PROPERTIES-PC2 command No. 590 which controls simple or continuous span. See Note 7.

A. Simple span, pretensioned or post tensioned. There is one stage of construction and all loads are applied to that stage. Do not code more than one span.

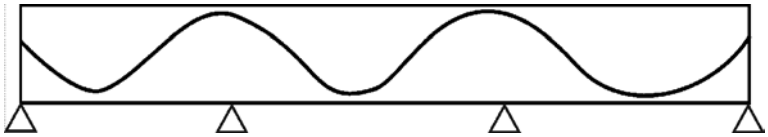




(Continued)

COMMAND PARAMETERS (Cont.)

B. Post tensioned continuous spans. There is one stage of construction and all loads are applied to that stage. Strands are all post tensioned. Falsework remains in place until after post tensioning. Entry 4 of the PROPERTIES-PC2 command must be coded 3.



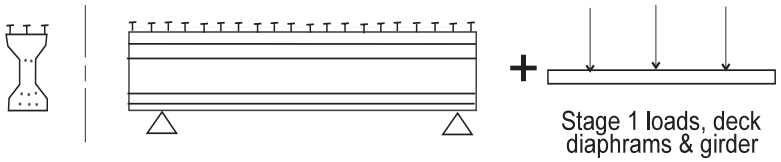
Note: BRASS cannot analyze a post tensioned frame structure with integral legs.

Code	Result

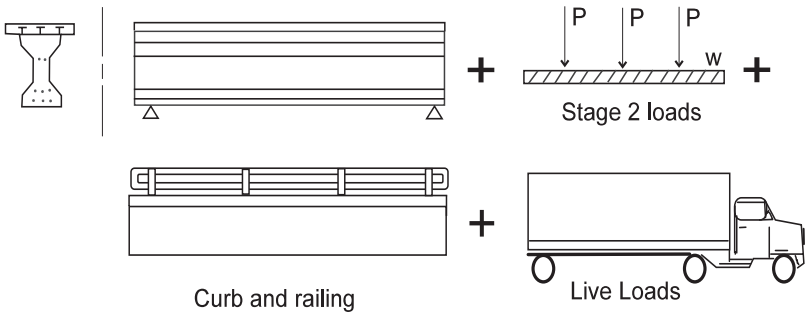
7 Prestressed concrete composite for live load. Also refer to PROPERTIES-PC2 command No. 590 which controls simple or continuous span. See Note 7.

A. Simple span composite. There are two stages of construction for this sequence. First the girder is modeled as non-composite and all stage one loads are applied. These are generally the deck and diaphragms. Secondly, the girder is modeled as composite and the stage 2 loads such as curb and wearing surface and live loads are applied. Do not code more than one span.

Stage 1



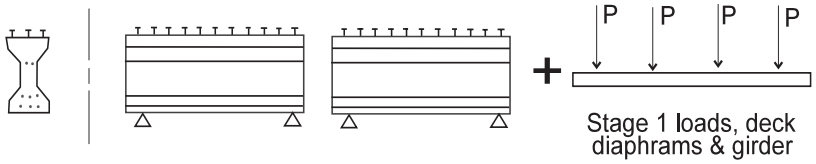
Stage 2



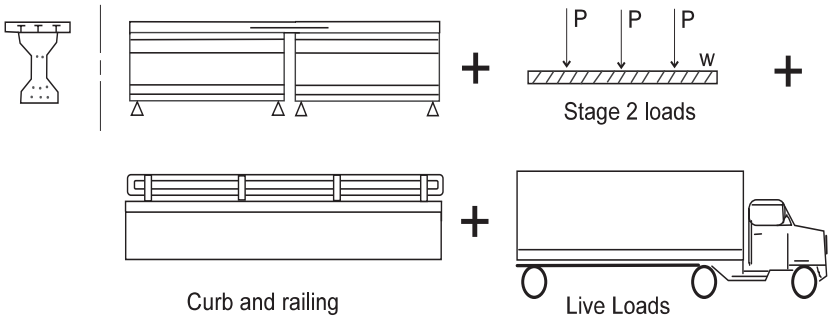
(Continued)

B. Simple span non-composite for dead load made continuous composite for live load by non-prestressed reinforcement. There are 2 stages of construction in this sequence. In the first stage the structure is modeled as simple span non-composite so BRASS places a hinge at each support and stage one loads such as girder and diaphragm weight are applied. Secondly, the bridge is made continuous connecting the girders over the supports using non-prestressed reinforcement. Hinges are removed. The structure also becomes composite at this time. The stage 2 loads, such as the curbs, live loads and loads due to differential creep and shrinkage, are applied. See Note 1.

Stage 1



Stage 2



(Continued)

COMMAND PARAMETERS (Cont.)	
Reinforced Concrete Shear Equation Default = 1	Code 1 to evaluate reinforced concrete shear using AASHTO Equation 8- 48. Code 2 to evaluate reinforced concrete shear using AASHTO Equation 8- 49.
Thermal Expansion Coefficient Default = 0.00065	Enter the thermal expansion coefficient for the girder material per 100° Fahrenheit. For example, for a steel girder code 0.00065.
Generate Points of Interest Default = 0 See Note 6	Enter one of the following codes to indicate if and how points of interest are to be generated. 0 = No point of interest data will be generated. Use commands listed in Note 5, as applicable, to define the points of interest. 1 = Points of interest at all tenth points along each top span will be analyzed. See Notes 2 and 5. 2 = Points of interest at all tenth points along all spans will be analyzed. See Notes 2 and 5. 3 = Points of interest at all tenth points along each top span and user-defined points of interest will be analyzed. See Notes 2, 3 and 5. 4 = Points of interest at all tenth points on all spans and user-defined points of interest will be analyzed. See Notes 2, 3 and 5. 5 = Only user-defined points of interest will be analyzed. See Notes 2, 3 and 5. If points of interest are to be generated, the program will apply schedule-based data input by the user to the appropriate points of interest.
Ignore Prestress Shear Default = 1 See Note 4	Code 1 if prestress shear rating is to be ignored. The default is 1 which enables old LFD data sets without prestress shear data to run to completion. Code 0 if prestress shear rating is desired.
Ignore Positive Moments Over Interior Supports Default = 0	Code 1 if positive moments over interior supports is to be ignored for simple span pretensioned prestressed girders made continuous for live load.
Ignore Compression Reinforcement for Analysis of Non-Prestressed Reinforced Concrete Only Default = 0	Code 1 to have reinforcement steel rows 4 and 5 (see XSECT-G command on Page 9.20) ignored for positive moment and rows 1, 2, and 3 ignored for negative moment. This would generally be an option for the rating of reinforced concrete slab bridges. If '1' is entered, the rows of reinforcing steel in the compression area will be ignored at all points of interest when calculating moment capacity. **Note:** This does not apply to composite steel or prestressed concrete girders.

EXAMPLE

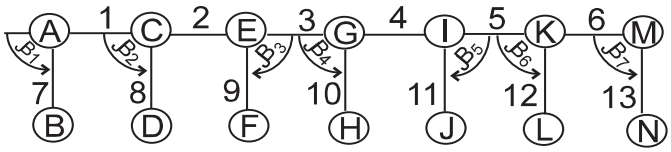
For a 3 span composite steel and concrete girder bridge, a printout of girder properties is desired and only user-defined points of interest will be analyzed:

ANALYSIS 1, 0, 4, , , 5

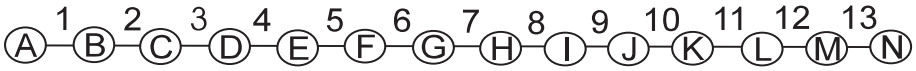
For a 3 span composite steel and concrete girder bridge, minimal output is desired, the thermal expansion coefficient is 0.00060, and points of interest are to be generated along the top span only:

ANALYSIS 0, 0, 4, , 0.00060, 1

FIGURES



FRAME TYPE



NON-FRAME TYPE
(Use only if you have more than 6 Continuous Spans)

Figure 1

NOTES

1. At this time, BRASS cannot model continuous post-tensioned pretensioned hollow core slabs with additional positive and negative non-prestressed reinforcement in the negative moment region.

2. One or more INTERMEDIATE-OUTPUT commands (1026) may also be used. See pages 14.21a and 14.21c.

3. One or more POINT-OF-INTEREST commands (1025) are required for the additional user defined points.

4. Prestress shear rating requires schedule based input of shear data. See Command 428, STIRRUP-GROUP, Command 497, STIRRUP-SCHEDULE, and Command 1025, POINT-OF-INTEREST. Do not use the PRESTRESS-1 and PRESTRESS-2 commands.

5. Do not use the STEEL-1, STEEL-2, STEEL-4, CONCRETE-1, CONCRETE-2, PRESTRESS-1, and PRESTRESS-2 commands with this option.

NOTES

6. The stirrup schedule based commands may not be used when requesting allowable stress design ratings for reinforced concrete or prestressed concrete girders.

7. Prestressed concrete girders can only be rated using Load Factor Design.

8. Generally, steel and concrete composite box girders have a wide thin bottom flange that is internally stiffened. At this time, BRASS handles the section as an equivalent I-beam and does not account for internal stiffening of the bottom flange. Hence, when rated for negative moment capacity, the bottom flange will generally fail in compression as it will have a low F_{cr} which is calculated by the formula (4400 x t/b)**2 <= Fy. When the girder is coded as '41', the program will assume the bottom flange is stiffened and the thickness meets AASHTO Equation 10-139 and the yield stress Fy will be used for the rating.

320	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	ANGLE -1	AN1
PURPOSE	This command defines the angle of the legs (columns) with respect to the top spans. This command is optional and required only when there are upright members not perpendicular to the top spans.	

6 COMMAND PARAMETERS

β 1 Default = 90°	Enter the angle β_1 in degrees between the horizontal and member 7. See Figures.
β_2 Default = 90°	Enter the angle β_2 in degrees between member 1 and member 8. See Figures.
β_3 Default = 90°	Enter the angle β_3 in degrees between member 3 and member 9. See Figures.
β_4 Default = 90°	Enter the angle β_4 in degrees between member 3 and member 10. See Figures.
β_5 Default = 90°	Enter the angle β_5 in degrees between member 5 and member 11. See Figures.
β_6 Default = 90°	Enter the angle β_6 in degrees between member 5 and member 12. See Figures.

EXAMPLE

For the example structure shown in Figure 3 below:

ANGLE-1 , 65, 65

FIGURES

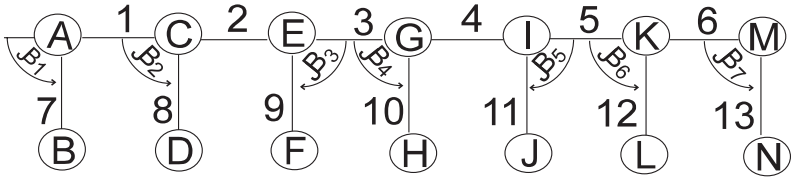


Figure 1 - BASIC STRUCTURE

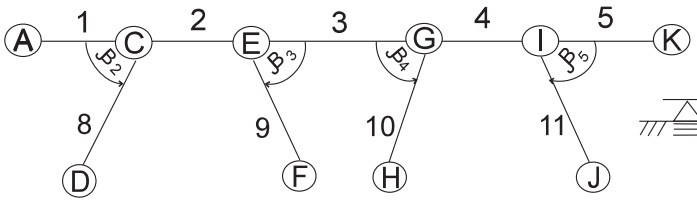


Figure 2 - SLANT LEG LAYOUT

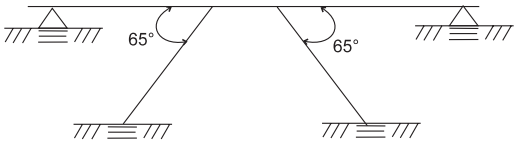


Figure 3

NOTES

330	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	ANGLE-2	AN2
PURPOSE	This command defines the angle of leg (column) (member 13) with respect to the top spans. This command is optional and required only when member 13 is not perpendicular to the top span.	

1 COMMAND PARAMETER

β_7 Default = 90°	Enter the angle β_7 in degrees between member 6 and member 13. See Figures.

EXAMPLE

For the example structure shown in Figure 3 below:

ANGLE-2 115

FIGURES

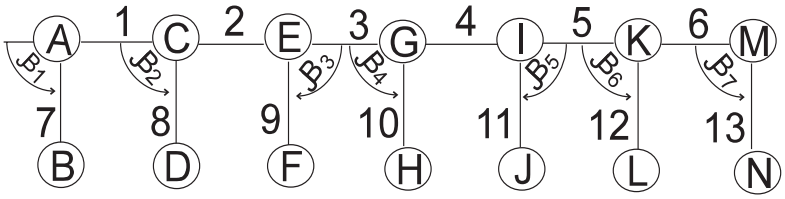


Figure 1 - BASIC STRUCTURE

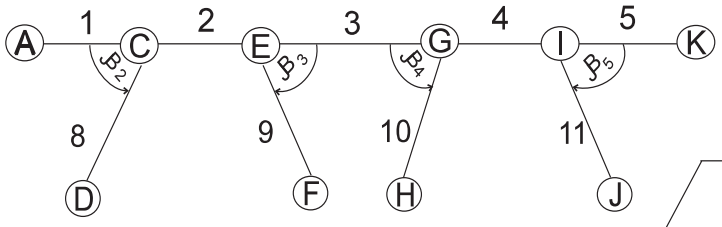


Figure 2 - SLANT LEG LAYOUT

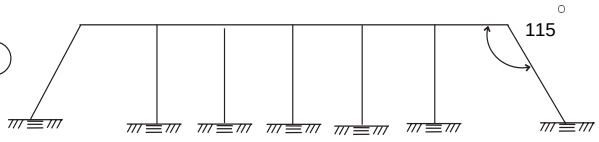


Figure 3

NOTES

9. TYPICAL CROSS SECTIONS AND SCHEDULE GROUP DATA

The XSECT-xxxx commands are to be used to describe up to a maximum of 100 girder cross sections. Four methods may be used.

1. Standard section file. BRASS contains a file of standard rolled shapes and other standard girder cross sections. Cross sections which reside on the Standard Section File are accessed with the XSECT-STD command.

2. Cross section by elements. A cross section with elements such as web, top flange, bottom flange, cover plates, and fillets is described by the XSECT-A through XSECT-H commands.

3. Cross section by coordinates. In the case of irregularly shaped cross sections, the cross section may be described by the x, y coordinates of its exterior and interior perimeter points using the XSECT-COORD1 and XSECT-COORD2 commands. **NOTE:** These commands can only be used to generate cross section properties and get actions due to loads. When using these commands, BRASS cannot analyze the strength of the section or perform ratings.

4. A circular cross section can be described by the cross section number 101. No XSECT-xxxx commands are required. The web depth defined by the SPAN-A command gives the diameter of the circular section. The web case must be 1. The cross section number used in the SPAN-C and SPAN-D must be 101.

5. When describing a prestressed concrete girder, a constant cross section may be required between supports except for changes to the composite concrete deck dimensions and/or composite concrete deck reinforcing steel. End blocks will affect the neutral axis location and may cause incorrect end moments to be applied to the beam. This problem will occur when the end of the development length + debond length falls within the end block. If omission of the end block creates a low shear capacity, a second analysis may be performed with the end block in place. Another option would be to increase the % of the concrete in shear in the region of the end block based on the area of the additional concrete. See the STIRRUP-SCHEDULE command, parameter 6. If the end block section is omitted, the additional weight of the concrete due to the end block may be applied using the LOAD-DESCR and UNIFORM-DL1 commands.

Each unique cross section except circular cross sections is given a cross section number. Define each non-circular cross section number in ascending order using appropriate XSECT-xxxx commands.

The “GROUP” commands are used to describe the properties of various elements such as transverse stiffeners and stirrups that are then located on the girder by the use of “SCHEDULE” commands for each span which are defined in Chapter 10.

340	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	XSECT-STD	XST
PURPOSE	This command allows the user to describe girder cross sections by a number for which the cross section properties are stored in a library. This library may be created and maintained by the user. See Section 15. This command is optional and may be repeated as 100 unique cross section numbers are allowed.	
6 COMMAND PARAMETERS		
Cross Section Number	Enter the number for the unique cross section to be described by the library Standard Designator entered in the next command parameter. Up to 100 unique cross section numbers are allowed. Some may be defined by this command and others may be defined by input parameters using XSECT-A through XSECT-H commands or by XSECT-COORD1 & 2 commands. The order of entering cross section numbers should be sequential. In other words a mix of commands to describe girder cross sections may be utilized as long as the cross section numbers are sequential. See Notes.	
Standard Designator	Enter the designated code for the standard cross section to be stored under the cross section number in the preceding parameter. A list of standard cross sections available in the BRASS library may be printed separately, see Section 15. See Note 3.	
Cross Section Number	Enter the number for the unique cross section to be described by the library Standard Designator entered in the next command parameter. Up to 100 unique cross section numbers are allowed. Some may be defined by this command and others may be defined by input parameters using XSECT-A through XSECT-H commands or by XSECT-COORD1 & 2 commands. The order of entering cross section numbers should be sequential. In other words a mix of commands to describe girder cross sections may be utilized as long as the cross section numbers are sequential. See Note 4.	
Standard Designator (Continued)	Enter the designated code for the standard cross section to be stored under the cross section number in the preceding parameter. A list of standard cross sections available in the BRASS library may be printed separately, see Section 15. See Note 3.	

COMMAND PARAMETERS (Cont.)	
Cross Section Number	Enter the number for the unique cross section to be described by the library Standard Designator entered in the next command parameter. Up to 100 unique cross section numbers are allowed. Some may be defined by this command and others may be defined by input parameters using XSECT-A through XSECT-H commands or by XSECT-COORD1 & 2 commands. The order of entering cross section numbers should be sequential. In other words, a mix of commands to describe girder cross sections may be utilized as long as the cross section numbers are sequential. See Note 4.
Standard Designator	Enter the designated code for the standard cross section to be stored under the cross section number in the preceding parameter. A list of standard cross section available in the BRASS library may be printed separately, see Section 15. See Note 3.

EXAMPLE

See figure and notes.

```
XSECT-STD       1,    WN36X150 (See Note 3)
XSECT-A         1,    36
XSECT-C         15,   1.5,          0,    15,    1.5
XSECT-STD       2,    WN36X280,           3,     W36X176 (See Note 3)
```

FIGURES

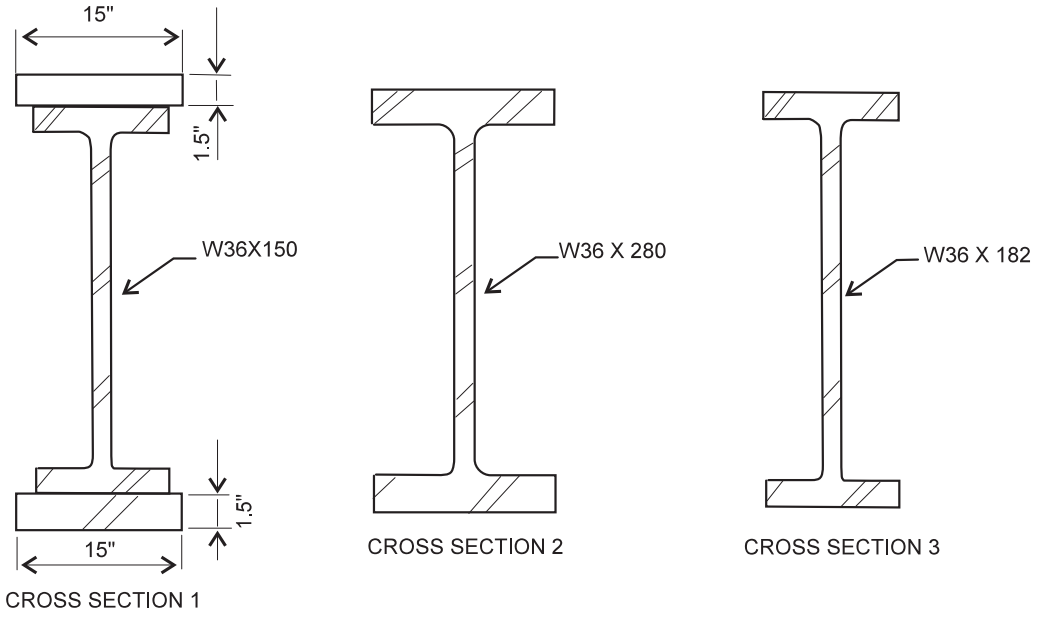


Figure 18

NOTES

1. The yield stress of the rolled steel shapes defaults to 36 ksi. This may be overridden by using the XSECT-A command, one for each cross section number.

2. The above codes are for this example only and may not reside in your particular standards library. It is possible to add elements to a standard section as for example top & bottom cover plates. To do this, use the same cross section number and the appropriate commands. See example above.

3. In the standard sections library, some standard shapes begin with "W" and "WN" (i.e., W24X76 and WN24X76). In 1985, AISC changed the dimensions of several steel shapes while keeping the same designation. To differentiate between the two types (especially when the older shape is needed to perform a rating) an "N" was added to the shape designation to indicate a NEW shape.

4. Do not use if XSA-XSG commands to follow as in the case of composite or cover plated section. If cover plates are going to be added to a standard section, using XSA-XSG commands, the standard section must be the only Standard Designator in the XST command. If more than one standard section is used in the structure, add other XST commands as needed.

If both standard sections and welded plate girders are used in a structure, do not use the XSECT-STD Command. Code the standard sections as welded plate girders using the appropriate average dimensions.

350	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	XSECT-A	XSA
PURPOSE	This series of commands (XSECT-A through XSECT-H) of which this is the first, allows the user to describe girder cross sections made up of the elements of an I along with cover plates and fillets. This command is required when cross sections are to be defined in this way. Up to 100 unique cross sections may be defined. Cross section elements may be added to cross sections described in the standard sections library or by x-y coordinates of perimeter points. A set or partial set of XSECT-A through XSECT-H is required for each cross section so described.	

5 COMMAND PARAMETERS

Cross Section Number	Enter the unique cross section number to be defined by the following parameters on this command and XSECT-B through XSECT-H commands. The order of entering cross section numbers must be sequential. See Note 1.
F_y Default = 36	If this is a steel girder, enter the yield strength of the web steel in ksi.
F_y Top Flange Default = F_y web	If this is a steel girder, enter the yield strength of the top flange in ksi.
F_y Bottom Flange Default = F_y web	If this is a steel girder, enter the yield strength of the bottom flange in ksi.
Cover Plate Indicator	Code 1 if this cross section is in a non-composite region AND has a steel top cover plate. See Note 2. Leave blank if this cross section is in a composite region of a composite steel and concrete bridge and has a steel top cover plate. See Notes on Page 9.7 and 9.22 regarding how BRASS computes slab steel reinforcing in a composite section.

EXAMPLE

For a girder cross section with cross section number = 1, composed of A36 steel, the XSECT-A command would be coded as follows:

XSECT-A 1, 36,

FIGURES

NOTES

1. When describing a prestressed concrete girder, a constant cross section may be required between supports except for changes to the composite concrete deck dimensions and/or composite concrete deck reinforcing steel. End blocks will affect the neutral axis location and may cause incorrect end moments to be applied to the beam. This problem will occur when the end of the development length + debond length falls within the end block. If omission of the end block creates a low shear capacity, a second analysis may be performed with the end block in place. Another option would be to increase the % of the concrete in shear in the region of the end block based on the area of the additional concrete. See the STIRRUP-SCHEDULE command, parameter 6. If the end block section is omitted, the additional weight of the concrete due to the end block may be applied using the LOAD-DESCR and UNIFORM-DL1 commands.

2. BRASS-GIRDER™ will not accommodate a steel-concrete section with a top steel cover plate and composite slab or rebar. To describe a top steel cover plate in a composite section, merge the cover plate area into the top flange and do not code a "1" as the cover plate indicator. See note on Page 9.21.

360	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	XSECT-B	XSB
PURPOSE	This is the second in a series of commands to allow the user to describe a typical girder cross section made up of the elements of a I along with cover plates and fillets.	

7 COMMAND PARAMETERS

WT_T	Enter the thickness of the web at the top of the web, in inches. See WT_T in Figure 1.
WT_B Default = WT_T	Enter the thickness of the web at the bottom of the web, in inches. See WT_B in Figure 1.
B_2	Enter the width, in inches, of the bottom flange. See B_2 in Figure 1 and Note 3.
B_3 Default = B_2	Enter the width, in inches, of the top flange. See B_3 in Figure 1. For concrete T girders, see Note 2. For steel girders, see Note 3.
T_1	Enter the thickness, in inches, of the top flange. See T_1 in Figure 1.
T_2 Default = T_1	Enter the thickness, in inches, of the bottom flange. See T_2 in Figure 1. Code 0 if no bottom flange.
B_4 Default = B_3	For concrete T girders, enter the top flange width, in inches, to be used to calculate the girder self weight. See Note 2.

EXAMPLE

For the typical girder cross section shown below in Figure 2, enter:

XSECT-B .75, , 14, , 1.5, 1.5

FIGURES

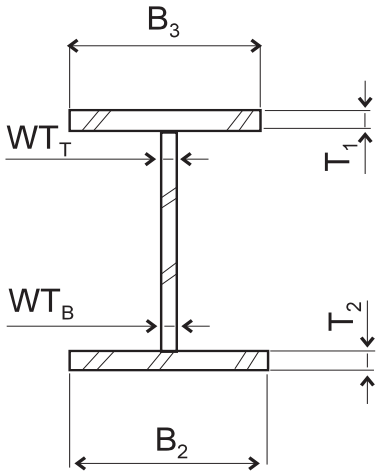


Figure 1

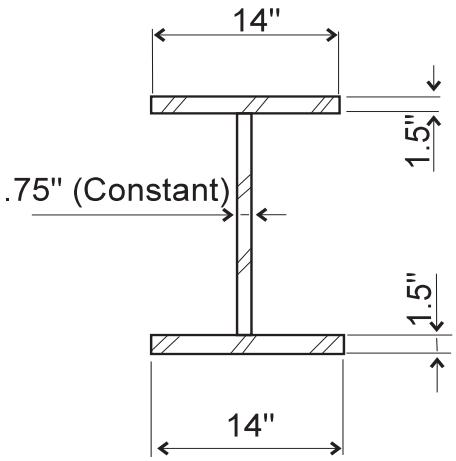
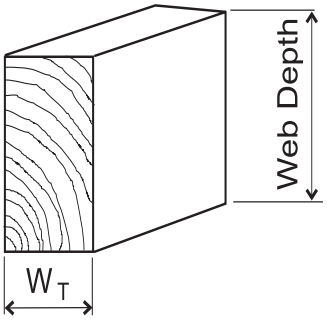
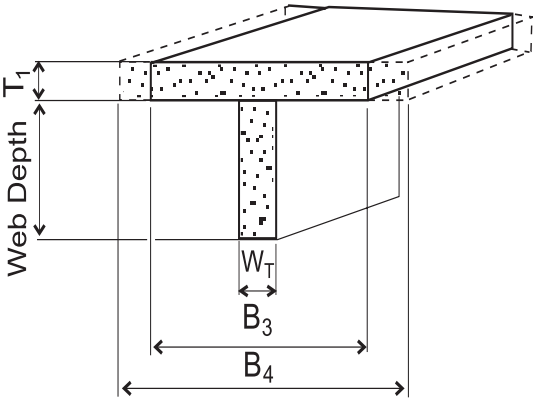


Figure 2

NOTES

1. A typical cross section can be defined by one or more of the elements as long as one element is the web and the elements are contiguous. For example, a timber beam can be described by WT only. The web depth is described by SPAN-A and SPAN-B commands as it may vary longitudinally. A concrete T girder may be defined by WT, B_3, T_1, and B_4.



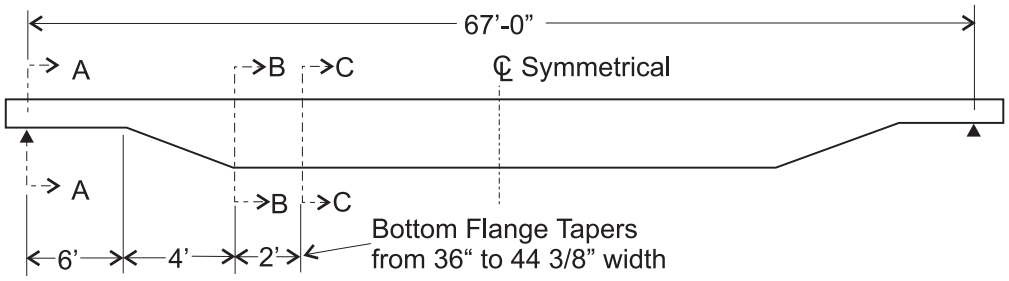


2. For concrete T girders, BRASS uses the value of the effective top flange width (B_3) to calculate the section properties. When wide girder spacings exist, the effective flange width for section properties is limited by AASHTO 8.10.1.1, which may be less than the girder spacing. Generally, B_4 will equal the girder spacing.

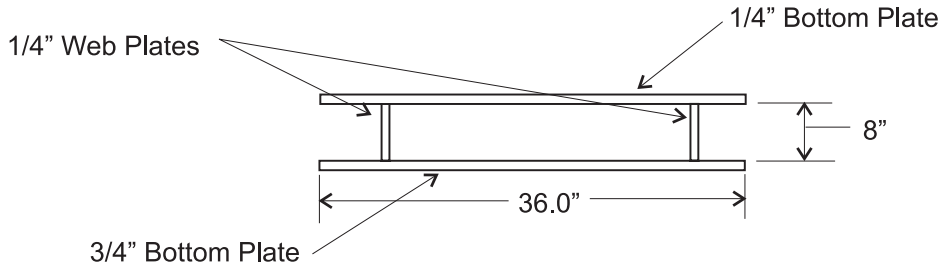
3. For a girder section composed of a web plate, angles, **and** flange plates, see Notes on page 9.23.

EXAMPLE

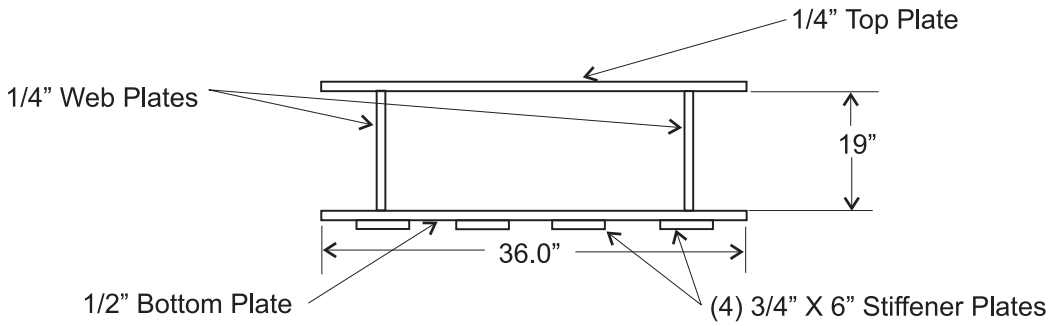
Railroad Car Girder had (3) discrete box sections



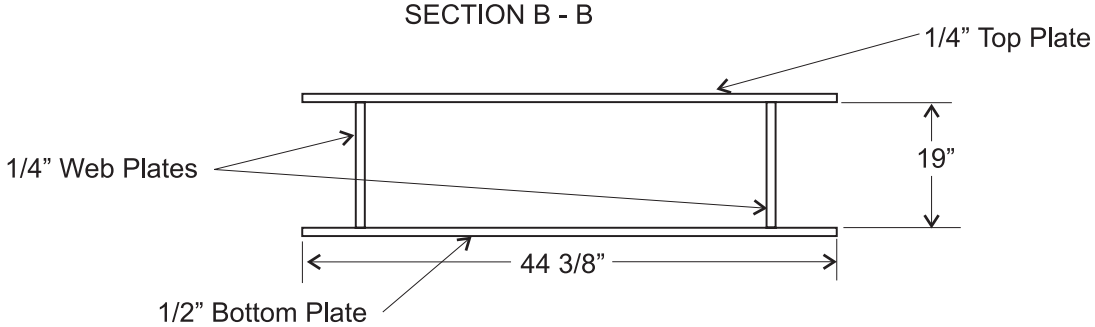
PROFILE



SECTION A - A



SECTION B - B



SECTION C - C

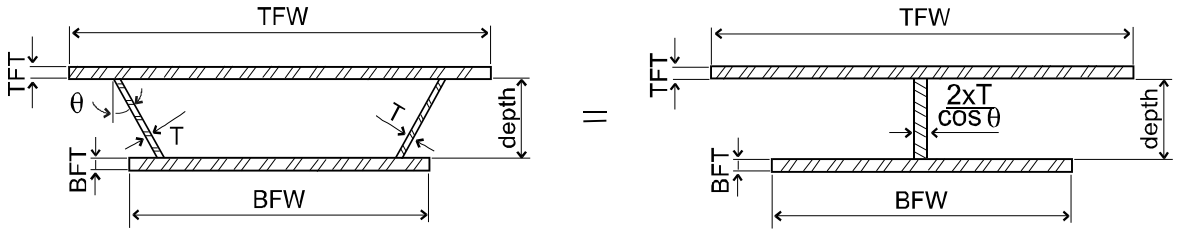
EQUIVALENT FULL SECTION OF A STEEL BOX GIRDER
WITH VARYING WEB DEPTH

(continued)

```
COM ***** Cross Section Information *****
COM
XSECT-A     1
XSECT-B     0.50,    ,        36.00,  ,  0.25,    0.75
COM
XSECT-A     2
XSECT-B     0.50,    ,        36.00,  ,  0.25,    0.50
XSECT-C     ,        ,        ,          24.00,   0.75
COM
XSECT-A     3
XSECT-B     0.50,    ,        44.375,    ,        0.25,  0.50
COM
COM ***** Span Length and Section Layout *****
COM
SPAN-A      1,       67.00,   4,         8.0,     6.0
SPAN-B      8.0,     10.0,    19.0,      57.0,    19.0,  61.0
SPAN-B      8.0
SPAN-RANGE  1,       1,       1,         1,1
SPAN-C      1,       10.0,    1,         2
SPAN-D      12.0,    3,       3,         55.0,    3,3
SPAN-D      57.0,    2,       1,         67.0,    1
```

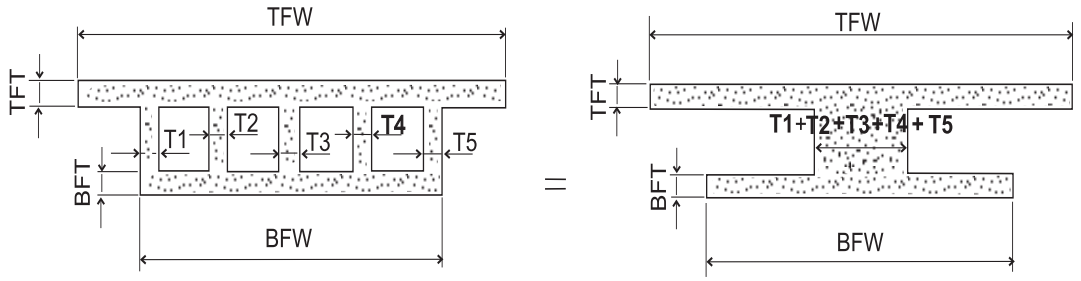
EQUIVALENT FULL SECTION OF A STEEL BOX GIRDER
WITH VARYING WEB DEPTH

EXAMPLE



EQUIVALENT FULL SECTION OF A STEEL BOX GIRDER
WITH CANTED WEBS

EXAMPLE



EQUIVALENT FULL SECTION OF A CONCRETE BOX GIRDER

NOTES

NOTE: The above examples illustrate how box beam cross sections can be approximated so the dimensions can be entered into BRASS commands.

370	BRASS-GIRDER™	COMMAND DESCRIPTION
COMMAND NAME	**XSECT-C**	**XSC**
PURPOSE	This, the third in the series of commands, allows the user to describe a typical girder cross section made up of the elements of an I with possible cover plates.	
6 COMMAND PARAMETERS		
B_4	Enter the width of the effective concrete flange, in inches, for a composite prestressed or steel girder section or the width of a top cover plate for a steel girder section. See B_4 in Figure 1 and Notes 1, 2, and 3.	
T_3	Enter the effective concrete flange thickness, if composite, in inches, or the thickness of the top cover plate. See T_3 in Figure 1 and Notes 1, 2, and 3.	
D_4 Default = 0	Enter the distance, in inches, between the top of the top flange and the bottom of the composite slab or cover plate. See D_4 in Figure 1.	
B_5	Enter the width, in inches, of the bottom cover plate. See B_5 in Figure 1 and Note 3.	
T_4	Enter the thickness, in inches, of the bottom cover plate. See T_4 in Figure 1 and Note 3.	
D_5 Default = 0	Enter the distance, in inches, between the bottom flange and the bottom cover plate. See D_5 in Figure 1.	

EXAMPLE

For the typical girder cross section shown below in Figure 2, enter:

XSECT-C 82, 8, 0, 14, 1.5, 0

FIGURES

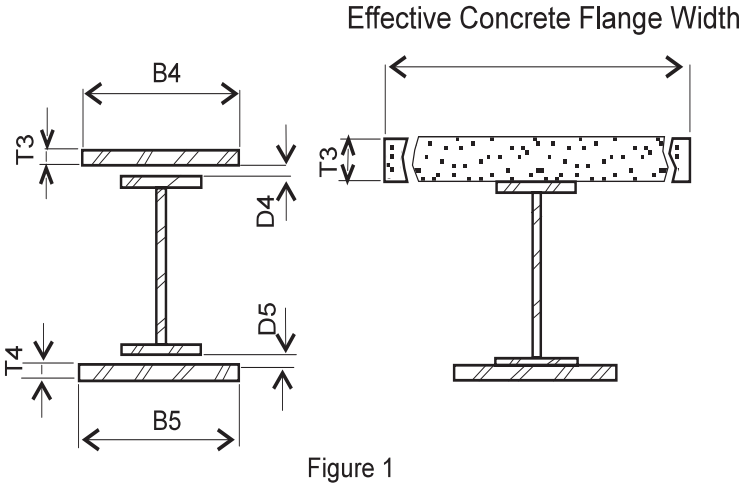


Figure 1

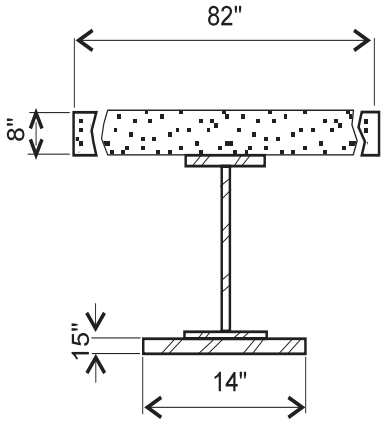


Figure 2

NOTES

1. The dead load of the effective concrete flange width is not included in the girder dead load. The weight of a steel cover plate is included in the girder dead load.

2. For prestressed composite concrete girder ratings, do not adjust the width of the effective concrete slab (B_4) using the modular ratio ($n = E_S / E_G$). BRASS does adjust the effective flange width prior to calculating the section properties. Also, IAW AASHTO Specifications 8.10, 9.81, 10.38.3, and 10.50.2.3, the reinforcing steel should be included in the effective flange width before transformation. In other words, enter the reinforcing steel in the effective flange width and not in the adjusted width.

3. If a standard section has an effective concrete flange, a top cover plate, or a bottom cover plate *as part of the section defined in the standard sections library*, parameters 1, 2, 4, and/or 5 **will not override** the library values. If the value for the *girder* area is not in the library (see Notes 1 and 2 on page 15.21), BRASS-GIRDER™ will compute the *total* area (girder plus cover plates), *total* moment of inertia about the x axis, and distance from the bottom of the bottom cover plate to the centroid of the *total* section. These values will be shown in the BRASS-GIRDER™ analysis output file for the standard section. If an effective concrete flange is coded here or entered in the standard section library, it will not be added until Stage 2.

380	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	XSECT-D	XSD
PURPOSE	This, the fourth in the series of commands allows the user to describe a typical girder cross section made up of the elements of an I with fillets and/or tapers. This command is required if the cross section contains fillets and/or tapers. See Notes.	

6 COMMAND PARAMETERS

F_1	Enter the height in inches of the top tapers. See F_1 in Figure 2.
F_2	Enter the distance in inches to the top tapers. See F_2 in Figure 2.
F_3	Enter the height in inches of the top fillets. See F_3 in Figures 1 and 2.
F_4	Enter the width in inches of the top fillets. See F_4 in Figures 1 and 2.
F_5 Default = F_1	Enter the height in inches of the bottom tapers. See F_5 in Figure 2.
F_6 Default = F_2	Enter the distance in inches to the bottom tapers. See F_6 in Figure 2.

EXAMPLE

For the typical girder section shown below in Figure 3, enter:

XSECT-D 3, , 4, 4, 0

FIGURES

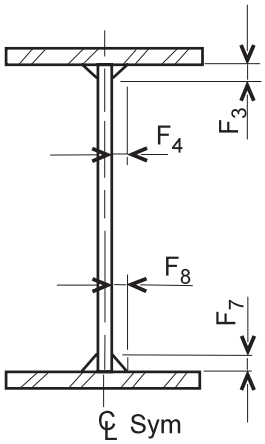


Figure 1

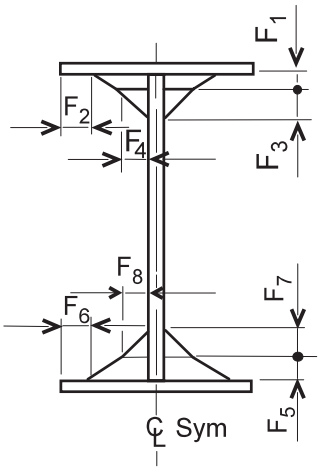


Figure 2

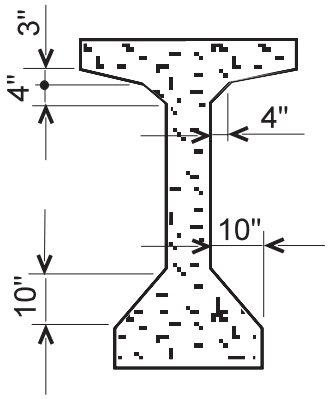


Figure 3

NOTES

Filets and tapers are not used in calculating the moment or shear strength of reinforced, non-prestressed I or T beams.

Do not use tapers unless fillets are present.

390	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	XSECT-E	XSE
PURPOSE	This, the fifth in the series of commands allows the user to describe a typical girder cross section made up of the elements of an I with fillets and/or tapers. This command is required if the cross section contains fillets.	

2 COMMAND PARAMETERS

F_7 Default = F_3 See Page 9.14	Enter the height in inches of the bottom fillets. See F_7 in Figures 1 and 2.
F_8 Default = F_4 See Page 9.14	Enter the width in inches of the bottom fillets. See F_8 in Figures 1 and 2.

EXAMPLE

For the typical girder section shown below in Figure 3, enter:

XSECT-E 10, 10,

FIGURES

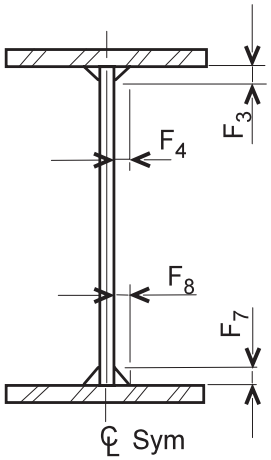


Figure 1

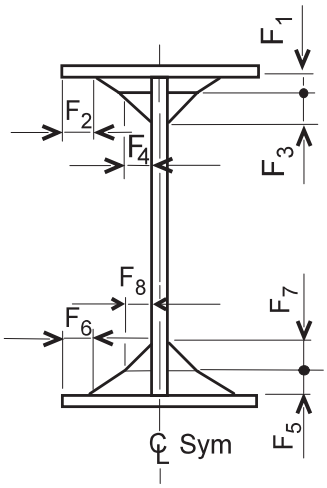


Figure 2

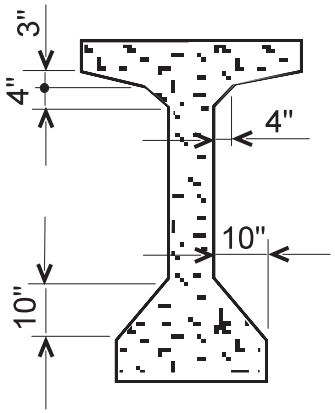


Figure 3

NOTES

400	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	XSECT-F	XSF
PURPOSE	This command defines the location of reinforcing steel for which the area is to be calculated by BRASS. This command is required for reinforced concrete girder reinforcement design. It is related to a cross section code and should be placed in order in the series.	

2 COMMAND PARAMETERS

D_1	Enter the desired distance to the centroid of reinforcing steel for design. BRASS will calculate the required area of reinforcement for the loads applied to the typical cross section being described. The distance to be entered in inches is from the bottom of the section to the centroid of the bottom row of reinforcement. See D_1 in Figure 1.
D_4	Enter the desired distance in inches to the centroid of the upper row of reinforcing steel the area of which is to be calculated by BRASS. See D_4 Figure 1.

EXAMPLE

It is desired to determine the area of reinforcing steel required in the typical cross section shown below in Figure 2. The required steel is to have its centroid at (a) - (a) & (b) - (b). Enter:

XSECT-F 2.5, 3.5

FIGURES

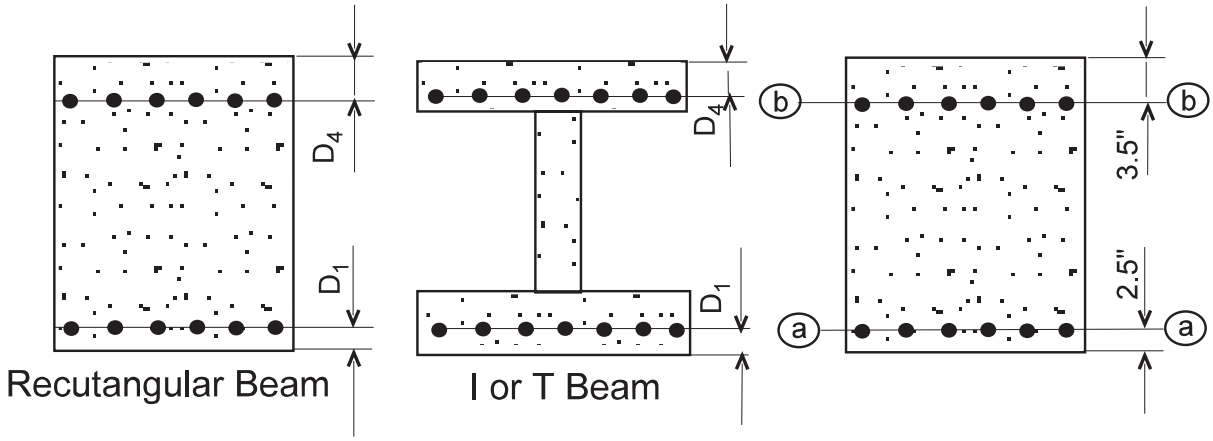


Figure 1 Figure 2

NOTES

BRASS will use D_1 and D_4 for the location of tension and/or compression reinforcement as required to carry the design loads.

410	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	XSECT-G	XSG
PURPOSE	This command defines the reinforcing steel in a typical cross section of reinforced concrete or continuous reinforcement in a composite steel and concrete girder. The 7th in the series available for describing a typical cross section. It is required for the rating or review of a reinforced concrete girder bridge or a composite steel and concrete girder bridge having continuous reinforcement in regions of negative moment. Repeat as often as needed.	
4 COMMAND PARAMETERS		
Row Number	Enter row number 1, 2, 3, 4, 5, 6, or 7. Row 1, 2, and 3 are reserved for bottom reinforcing and rows 4 and 5 are reserved for top reinforcing. Rows 6 and 7 are reserved for rebar in a composite slab (#6 in bottom and #7 in the top). See Figures. For steel girders with a composite deck, see Note 1. For prestressed composite girders, see Note 2. For multispan precast, prestressed concrete girders, see Note 3.	
Number of Bars	Enter the number of bars of this bar size in this row. This may be a fractional number as may be required in the case of a slab bridge or in the effective flange of a T-girder.	
Bar Size	Enter the bar size of the reinforcing bars to be described in this row. If more than one size appears in a row, repeat the command with the new bar size and same row number.	
Distance to Bar Center	Enter the distance in inches from the bottom of the girder if this is row 1, 2, or 3. Enter the distance from the top of the girder if this is row 4 or 5. Enter the distance to the top of the top flange if row 6 or 7. See Figures.	

EXAMPLE

For a typical rectangular cross section shown below in Figure 1, it is desired to calculate the load rating capacity of the cross section based on the reinforcing steel shown. The command would be used as follows:

```
XSECT-G   1,   5,   8,   2
XSECT-G   2,   2,   9,   4
XSECT-G   4,   2,   8,   3
XSECT-G   4,   2,   7,   3
```

FIGURES

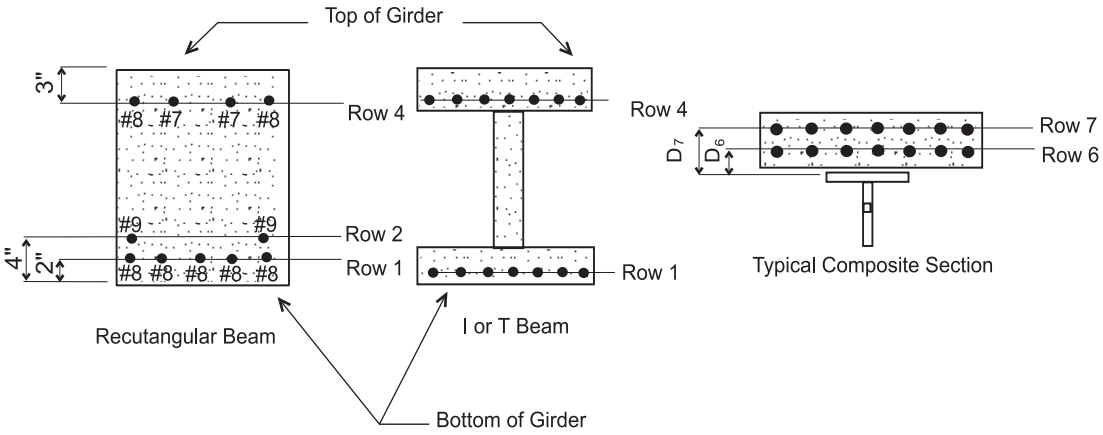


Figure 1

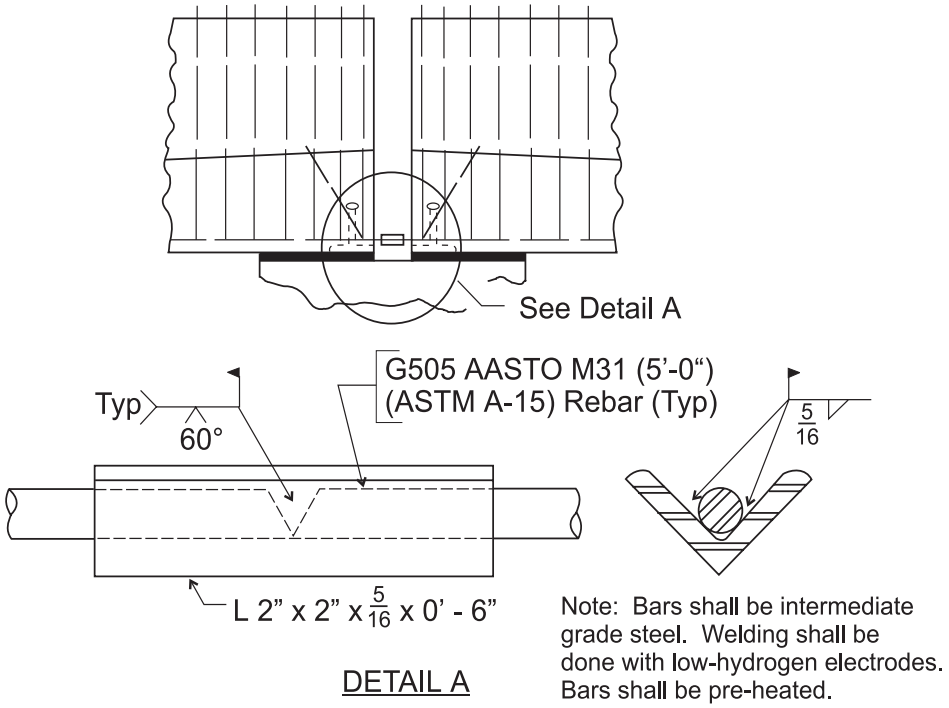

See Detail A
Typ
60°
G505 AASTO M31 (5'-0")
(ASTM A-15) Rebar (Typ)
5/16
L 2" x 2" x 5/16 x 0' - 6"
DETAIL A
Note: Bars shall be intermediate grade steel. Welding shall be done with low-hydrogen electrodes. Bars shall be pre-heated.

Figure 2

1. For **steel girders** with a composite slab, BRASS-GIRDER™ converts rows 6 & 7 to an equivalent steel cover plate. Do not use in regions of positive moment where both a composite slab and a steel top cover plate exist (See Note on Page 9.7). The weight of the equivalent steel cover plate is not included in the dead load of the girder. BRASS-GIRDER™ does not allow the input of reinforcing steel in the concrete slab to add to the strength of the section. The user may input the concrete slab dimensions or he may input the reinforcing steel data but not both in a cross section. Basically the user must define a composite section for positive moment and a composite section for negative moment. Therefore, the second term in the equation (10-123) and in (10-125) does not apply.

   Because the stresses in the concrete slab are generally low because of the size of the effective slab, we have assumed that ignoring the reinforcing steel is reasonable.

   In areas where the cross section only includes the reinforcing steel and is intended for negative moment but some positive moment may exist, the program does output a message that advises the user as follows:

   NOTE: BRASS does not calculate the plastic moment capacity including rebar for positive moment at this time. BRASS uses the greater of the plastic moment cap, w/o rebar or the elastic cap, w/rebar if braced.

   The above note is printed under the analysis point under consideration.

   In areas of negative movement of a composite steel and concrete girder bridge, the slab should not be input on the XSECT-C command when reinforcing steel is input.

2. For **prestressed composite girders**, both the reinforcing steel and slab may be entered and BRASS-GIRDER will calculate the correct section capacity based on the sign of the moments.

3. Due to the configuration of the spans, live loads placed in some multispan precast, prestressed concrete girder bridges cause some postive moments to occur over the bents. If no steel is defined to carry this moment, a zero rating will be output. Figure 2 on the previous page shows how 4 #5 bars were cast into the girder ends and welded together using 2" x 2" angles to carry this positive moment. This steel is defined in the XSECT-G command as row #1.

420	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	XSECT-H	XSH
PURPOSE	This command describes angles used with a web plate to make up an I girder. This command is valid for girder properties and girder dead and live load actions. However, if the girder is to be analyzed by the strength (load factor) design analysis method, see commands 1040 and 1050 for more information.	

6 COMMAND PARAMETERS	
Top Angles Vertical Leg	Enter the length in inches of the vertical leg of the top angles.
Top Angles Horizontal Leg	Enter the length in inches of the horizontal leg of the top angles.
Top Angles Leg Thickness	Enter the thickness in inches of the top angles
Bottom Angles Vertical Leg	Enter the length in inches of the vertical leg of the bottom angles.
Bottom Angles Horizontal Leg	Enter the length in inches of the horizontal leg of the bottom angles.
Bottom Angles Leg Thickness	Enter the thickness in inches of the bottom angles.

EXAMPLE

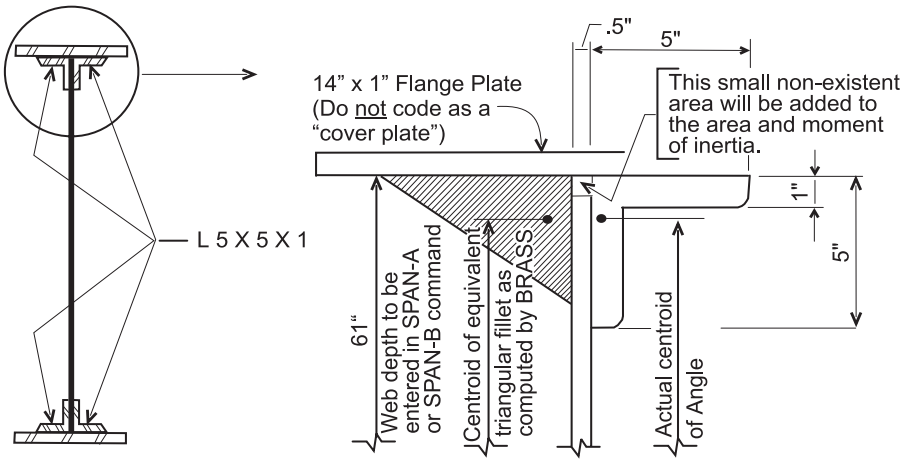
XSECT-H 5, 5, 1, 5, 5, 1

NOTES

BRASS-GIRDER™ analyzes built up sections using angles in two different ways - with flange plate(s) and without flange plate(s).

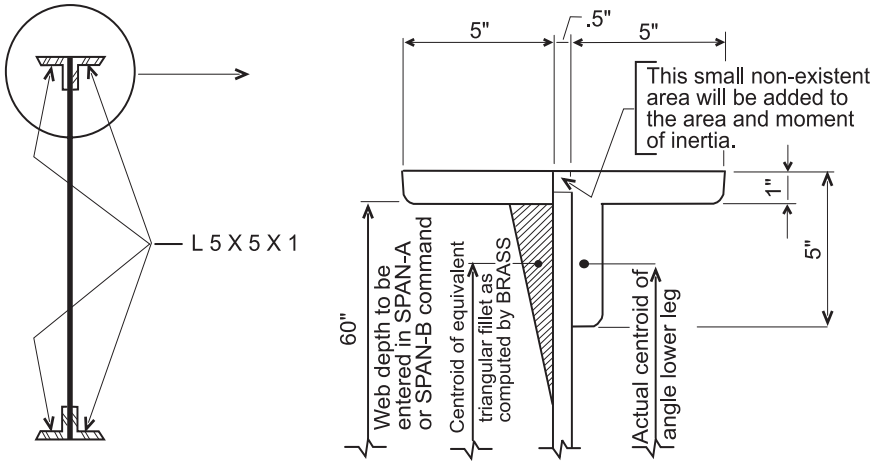
WITH FLANGE PLATES

For sections coded with either a top or bottom flange plate in the XSECT-B command, BRASS will convert the total angle area to an equivalent triangular fillet. BRASS will dimension the fillet such that the centroid of the equivalent triangular fillet will be located at the same point as the original angle. Web depth should be entered as the distance between the inside faces of the flange plates. NOTE: I_{IN}^4 may be higher than actual.



WITHOUT FLANGE PLATES

For sections without flange plates, BRASS will set the flange geometry equal to the portion of the angles comprising the flange. The portion of the angles connected to the web will be converted to an equivalent triangular fillet. BRASS will dimension the fillet such that the centroid of the equivalent triangular fillet will be located at the same point as the vertical leg of the angle. Web depth should be measured as the distance between the inside faces of the horizontal leg of the angles. NOTE: I_{IN}^4 may be higher than actual.



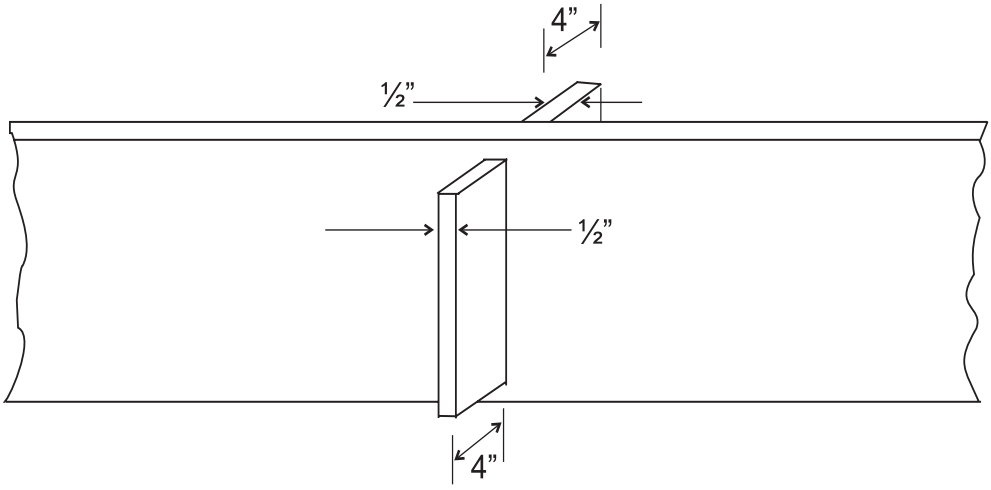
422	BRASS-GIRDER™	COMMAND DESCRIPTION	
COMMAND NAME		**STIF-TRAN-GROUP**	**STG**
PURPOSE		Use to define a group of transverse stiffeners that have similar geometry. The transverse stiffener groups defined with this command are used when defining the transverse stiffener schedule on the STIF-TRAN-SCHEDULE command. The STEEL-GIRDER-CONTROL command must also be used when using this command.	
5 COMMAND PARAMETERS			
Transverse Stiffener Group Number		Enter a unique number to define this group of transverse stiffeners.	
Width		Enter the width of the transverse stiffener, in inches.	
Thickness		Enter the thickness of the transverse stiffener, in inches. If a transverse stiffener design is desired, follow the instructions in Note 3 on Page 14.4.	
Type Factor Default = 2.4		Enter the transverse stiffener type factor. Stiffener Pairs: B = 1.0 Single Angles: B = 1.8 Single Plates: B = 2.4	
Fy Default = 36.0 ksi		Enter the yield stress of the steel used for the transverse stiffeners.	

EXAMPLE

To define a group of transverse stiffeners that are made of a pair of 1/2" x 4" A36 plates, code as follows:

```
STIF-TRAN-GROUP 1,   4,    0.5,        1.0,   36
```

FIGURES



NOTES

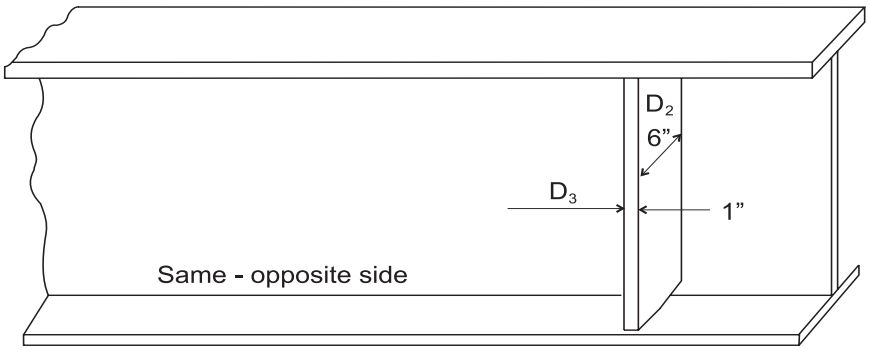
424	BRASS-GIRDER™	COMMAND DESCRIPTION	
COMMAND NAME		**STIF-BEAR-GROUP**	**SBG**
PURPOSE		Use to define a group of bearing stiffeners that have similar geometry. The bearing stiffener groups defined with this command are used when defining the bearing stiffener schedule on the STIF-BEAR-SCHEDULE command. The STEEL-GIRDER-CONTROL command must also be used when using this command.	
5 COMMAND PARAMETERS			
Bearing Stiffener Group Number		Enter a unique number to define this group of bearing stiffeners.	
Bearing Stiffener Width, D_2		If the analysis point being considered is at a support and a rating of the load carrying capacity of the bearing stiffener is desired, enter the width of the bearing stiffener, in inches. See Figure. Brass will calculate the load carrying capacity based on two stiffeners of size D_2 by D_3. If a bearing stiffener design is desired, follow the instructions in Note 3 on Page 14.4.	
Bearing Stiffener Thickness, D_3		If the analysis point being considered is at a support and a rating of the load carrying capacity of the bearing stiffener is desired, enter the thickness of the bearing stiffener, in inches. See Figure.	
Bearing Stiffener Clip, D_4 Default = 0.75		Enter the bearing stiffener clip dimension , in inches, parallel to the bottom flange of the girder. Only required at a span end if bearing stiffener analysis is desired. See Figure.	
Bearing Stiffener fy Default = 36.0 ksi		Enter the yield stress of the steel used for bearing stiffeners, in kips/sq. inch. Only required at a span end if bearing stiffener analysis is desired.	

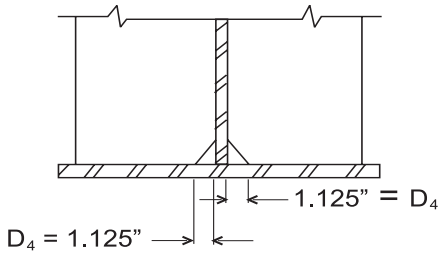
EXAMPLE

To define a bearing stiffener consisting of two grade 50, 1" x 6" plates with 1.125" clips for the fillet weld of the web to the flange, code as follows:

```
STIF-BEAR-GROUP 1, 6,   1,    1.125,        50
```

FIGURES





NOTES

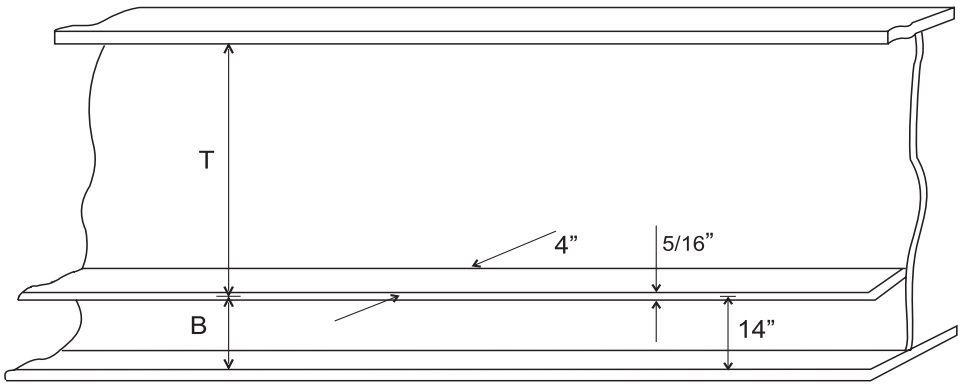
426	BRASS-GIRDER™	COMMAND DESCRIPTION	
COMMAND NAME		**STIF-LONG-GROUP**	**SLG**
PURPOSE		Use to define a group of longitudinal stiffeners that have similar geometry. The longitudinal stiffener groups defined with this command are used when defining the longitudinal stiffener schedule on the STIF-LONG-SCHEDULE command. The STEEL-GIRDER-CONTROL command must also be used when using this command.	
5 COMMAND PARAMETERS			
Longitudinal Stiffener Group Number		Enter a unique number to define this group of longitudinal stiffeners.	
Longitudinal Stiffener Width		Enter the width of the longitudinal stiffener, in inches. See Figure. If a longitudinal stiffener design is desired, follow the instructions in Note 3 on Page 14.4.	
Longitudinal Stiffener Thickness		Enter the thickness of the longitudinal stiffener, in inches. See Figure.	
Longitudinal Stiffener Location Default = Web Depth/5		Enter the distance, in inches, from the center of the longitudinal stiffener to the face of the flange denoted by the next parameter.	
Longitudinal Stiffener Reference		Enter 'T' if the distance to the longitudinal stiffener is measured from the face of the top flange. Enter 'B' if the distance is measured from the face of the bottom flange. See Figure.	

EXAMPLE

To define a group of longitudinal stiffeners that are made with 5/16" x 4" A36 plates located at 14" above the bottom of the web, code as follows:

```
STIF-LONG-GROUP 1, 4,    0.3125,       14,   B
```

FIGURES



NOTES

COMMAND NAME	STIRRUP-GROUP	SIG
PURPOSE	Use to define a group of stirrups that have similar geometry. The stirrup groups defined with this command are used when defining the stirrup schedule on the STIRRUP-SCHEDULE command.	
3 COMMAND PARAMETERS		
Stirrup Group Number	Enter a unique number to define this group of stirrups.	
Stirrup Area	Enter the area in inches^2 of the reinforcing steel in a stirrup. This will generally be twice the area of the reinforcing steel making up the stirrup.	
Stirrup Angle Default = 90°	Enter the angle between the stirrup and the horizontal. See Figure 1.	

EXAMPLE

For vertical double leg #4 stirrup, code as follows:

```
STIRRUP-GROUP    1, 0.4
```

FIGURES

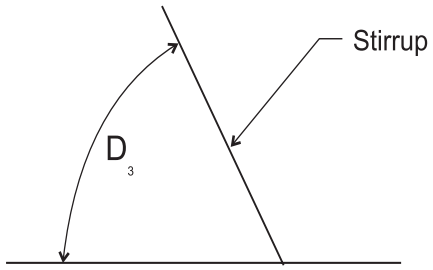


Figure 1

NOTES

430	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	XSECT-COORD1	XC1
PURPOSE	This set of commands, XSECT-COORD1 and XSECT-COORD2, describes a girder cross section by the x and y coordinates of points around the exterior perimeter and interior perimeter. These commands may be used when a typical cross section cannot be defined by an I section or is not in the standard shapes library. These commands are used ONLY to obtain the cross-section properties and actions due to loads. They may **not** be used for design , review, or rating. This command may NOT be used for the design of a prestressed concrete girder or a voided concrete slab.	

1 COMMAND PARAMETER

Cross-Section Number	Enter the unique cross section to be described by x, y coordinates on the XSECT-COORD2 commands to follow. Note: up to 20 unique cross section numbers are allowed. Some may be defined by a standard name (XSECT-STD command) and some may be defined by describing parts of an I (XSECT-A - XSECT-H commands). In other words a mix of commands may be used to describe girder cross sections as long as the cross section numbers are sequential.

EXAMPLE

If typical cross section 2 is to be described by x, y coordinates, enter:

XSECT-COORD1 2

FIGURES

NOTES

This set of commands may be used to model an unusual girder shape. BRASS will calculate the properties of the section and with these properties a structural model will be generated. Dead and live loads may be applied to this model and actions obtained.

The DESIGN and following commands should not be used as the subroutines in the program for calculating stresses and the strength of a section are basically designed for specific section shapes.

440	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	XSECT-COORD2	XC2
PURPOSE	This set of commands, XSECT-COORD1 and XSECT-COORD2, describes a girder cross section by the x and y coordinates of points around the exterior perimeter and interior perimeter. These commands may be used when a typical cross section cannot be defined by an I section or is not in the standard shapes library. These commands are used ONLY to obtain the cross-section properties and actions due to loads. They may **not** be used for design , review, or rating. This command may NOT be used for the design of a prestressed concrete girder or a voided concrete slab.	

6 COMMAND PARAMETERS	
X_I	Enter the x coordinate in inches of the Ith perimeter point of the typical cross section to be defined. See Figure and Notes.
Y_I	Enter the y coordinate in inches of the Ith perimeter point of the typical cross section to be defined. See Figure and Notes.
X_{I+1}	Enter the x coordinate in inches of the I + 1 perimeter point of the typical cross section to be defined. See Figure.
Y_{I+1}	Enter the y coordinate in inches of the I + 1 perimeter point of the typical cross section to be defined. See Figure.
X_{I+2}	Enter the x coordinate in inches of the I + 2 perimeter point of the typical cross section to be defined. See Figure.
Y_{I+2}	Enter the y coordinate in inches of the I + 2 perimeter point of the typical cross section to be defined. See Figure. Etc. to I + N N maximum = 59 (60 points)

EXAMPLE

For the section shown below in Figure 1, enter:

```
XSECT-COORD2    1,    21,    28,    21,    28,    1.5
XSECT-COORD2    16,   1.5,   13.5,  13,    10,    16
XSECT-COORD2    1.5,  18,    1,     21,    17,    16.5
XSECT-COORD2    19,   4,     24,    4,     24,    16.5
XSECT-COORD2    17,   16.5,  1,     21,
```

FIGURES

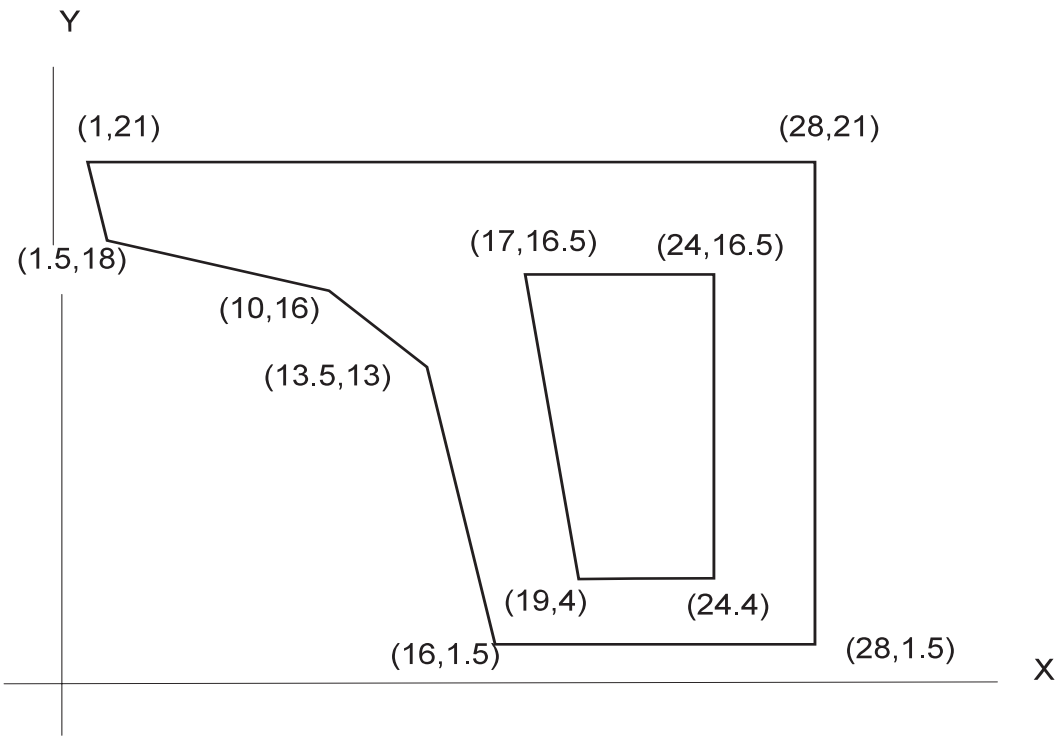


Figure 1

NOTES

For positive areas, enter the points in clockwise order, for negative areas (voids) enter the points in counter-clockwise order. Note: The beginning point of the whole section must be repeated for each void.

10. SPAN DESCRIPTION

Each span of a structure must be described by a subset of the commands defined in this chapter. These commands are repeated in blocks of commands for each span. See Typical Command Set 4 on page 4.5. Each command description explains if a command is required to be included in the block.

Several types of commands are described below.

The SPAN-xxx commands define the longitudinal girder geometry in terms of cross sections. This includes the web, flanges, and cover plates. The SPAN-A and SPAN-C commands are always required.

The xxxx-SCHEDULE commands define the longitudinal placement of girder appurtenances such as transverse stiffeners, stirrups, bearing stiffeners, etc. These define the range or location of appurtenances defined by the xxxx-GROUP commands. Appropriate xxxx-SCHEDULE commands are required if schedule-based input is requested by parameter 6 of the ANALYSIS command.

The FIXITY command defines the restraints at the end of each span and are required for each span unless the defaults are correct.

The optional SETTLEMENT command describes support settlements.

The optional HINGE command describes hinge locations and/or defines a maximum of two points per span where additional node points are desired in the finite element model.

**********NOTE**********

Numerical instability may result in the finite element analysis model if adjacent elements have grossly different stiffness. If the length of an element is less than 0.099 feet, the program will detect an error condition and stop with an error message.

BRASS-GIRDER™ places node points at span 1/10 points, the end of each web range, each cross section range, each hinge location, and each special analysis point location. If numerical instability error occurs, review the data presented by the error message for the location of the problem and then adjust one of the web or cross section ranges or other data that has caused two node points to be too close to each other. Tenth points cannot be changed. IMPORTANT: When node points are generated, ones that are too close together (less than 0.12 feet) will be merged into one node point. The girder properties report turned on by a “1" in parameter one of the ANALYSIS command will report each generated node followed by girder properties.

Span Lengths vs. Girder Lengths

As of Version 5.7, BRASS-GIRDER™ has the capability for pretensioned prestressed concrete girders to specify an overhang length. The overhang length is the distance from the end of the girder to the centerline of the bearing. Debond and transfer/development lengths are automatically adjusted as needed for this overhang length and they are to be dimensioned from the **end of the girder**. The user should follow the directions in each related command.

For simple spans made continuous for live load, BRASS still ignores the gap between the end of the girders over the piers.

460	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	SPAN-A	SPA
PURPOSE	This is the first of a series of commands defining each span of a structure. The longitudinal dimensions of each span, beginning and ending points of typical cross sections and web depth variation are entered. The SPAN-A command is always required in each series and a series is always required for each span of a structure. See Note on Page 10.7 Note: Spans are described from Left to Right or from Top to Bottom.	

7 COMMAND PARAMETERS

Span No.
Default = 1

Enter the number of the span being described. See "BASIC STRUCTURE" and "CONTINUOUS TYPE LAYOUT" in Figure 1 for span numbering order.

Span Length

Enter the length of the span, in feet. **Important** - Read section “Span Lengths vs. Girder Lengths” on page 10.1

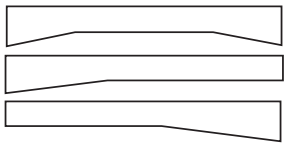
Web Case
Default = 1

Enter the web case type for this span. See Notes and Figure 2.

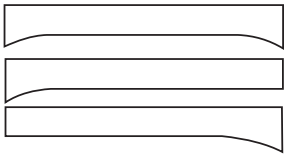
Code	Description
1	Linear Varying and Circular (see page 9.1, para. 4)

NOTE: Do not code a “1" if a standard cross section is input. See Web Case 5.

2 Linear Haunch with Parallel Horizontal Flanges Between Haunch(es)



3 Parabolic Haunch with Parallel Horizontal Flanges Between Haunch(es)



NOTE: Option 3 is a concave only.

(Continued)

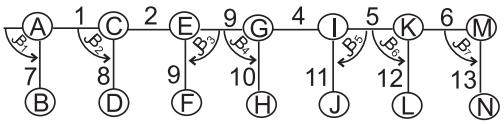
COMMAND PARAMETERS (Cont.)	
	Code **Description** 4 Complex Girder Depth See pages 8.3 and 10.6 for examples. **NOTE:** This option may require the use of the SPAN-RANGE command (see page 10.10).
	5* Standard sections input, web depth will be extracted along with other data from the Standard Sections Library.
	6* Typical cross sections described by the x - y coordinates of perimeter points. Web depth has no significance. *If Web Case = 5 or 6 no further web data is required. If Web Case is less than 5, continue.
D_1	Enter the web depth in inches at the left end of the span. For vertical or canted spans, the left end of the span is considered at the top. See D_1 in Figure 3. For sections composed of angles, see Figure on page 9.23. **NOTE** 1: See Pages 8.4 and 10.7 for explanation of web depth. Web depth includes the depth of tapers and fillets. **NOTE** 2: If a circular section, this is the diameter of the section.
D_2 Default = D_1	Enter the web depth in inches at the right end of the span. See D_2 in Figure 2.
R_1	Enter web range #1 in feet. See Range No. 1 in Figure 2. Not required for Web Case = 1, uniform varying
Intermediate Output Default = 0	Intermediate output for Web Case 4. 0 = No output, 1 = Output. Only input once (Span #1).

EXAMPLE

The example shown in Figure 4 will also be used for the example in the SPAN-B Command. The SPAN-A Command would be coded as shown in bold print:

COM Span 1 series
SPAN-A 1, 34, 3, 48, 72, 0
SPAN-B 48, 26.5, 48
COM
COM Span 2 series
SPAN-A 2, 36, 3, 72, , 13
SPAN-B 48, 22, 48
COM
COM Span 3 series
SPAN-A 3, 28, 4, 72, 48, 14
SPAN-B 48

FIGURES



BASIC STRUCTURE

CONTINUOUS TYPE LAYOUT
(Use only if you have more than 6 Continuous Spans)

Figure 1

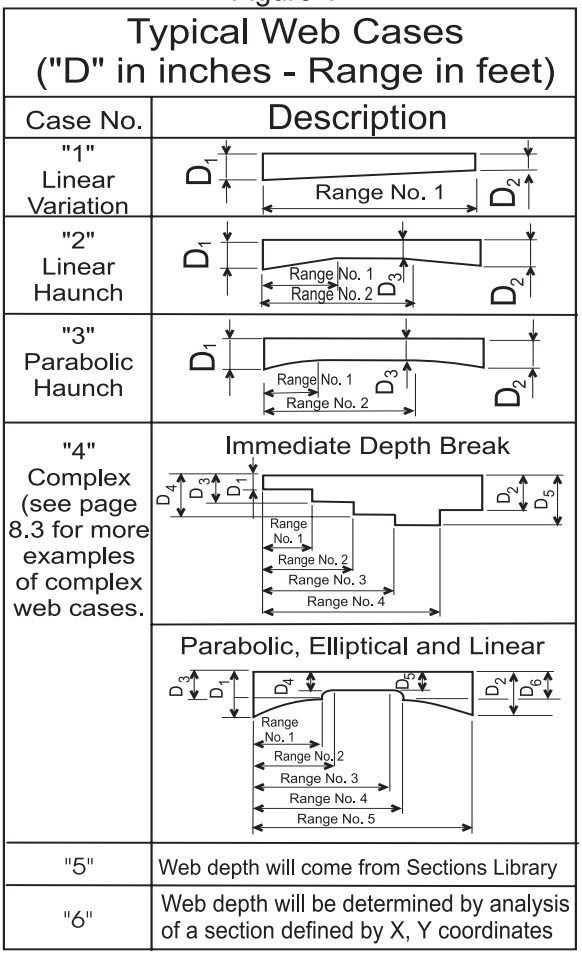


Figure 2

NOTES

When modeling a multispan bridge, one span may be a standard shape and another span may be built up sections. Though a span may consist of various standard sections or built up sections, a combination of standard sections and built up sections may not reside together in a span.

FIGURES

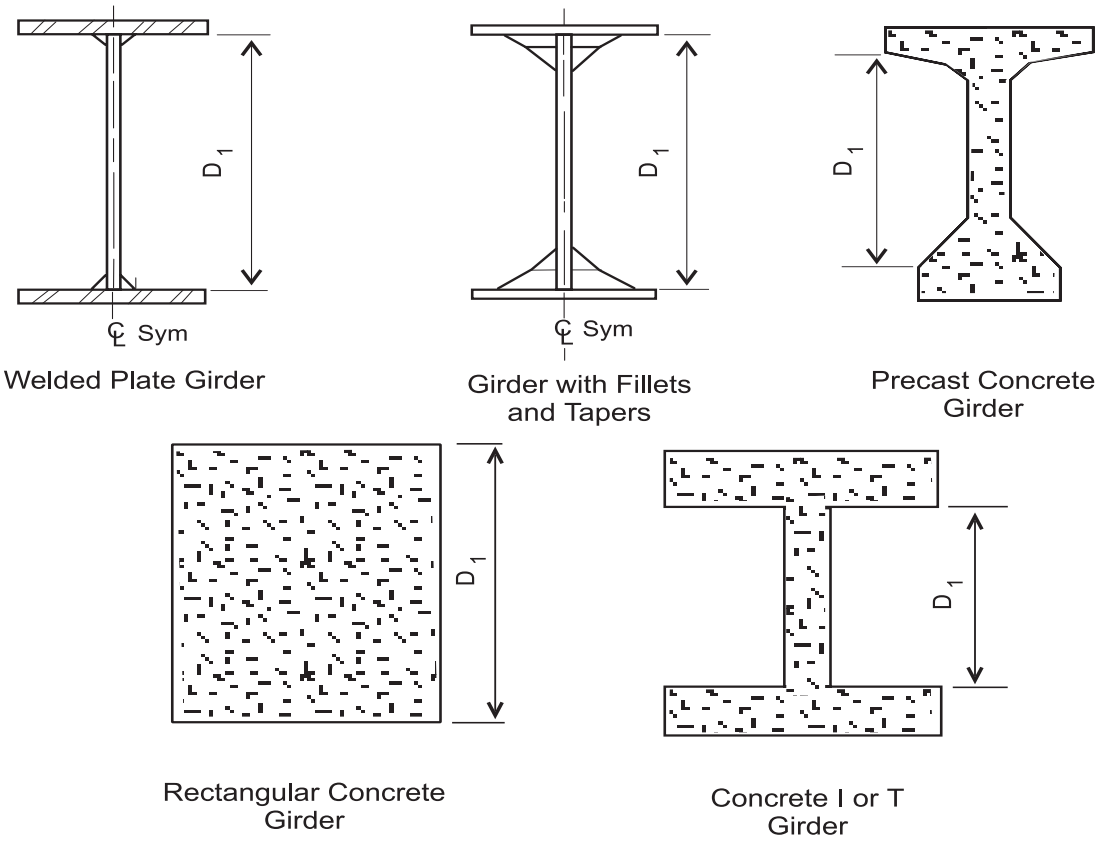


Figure 3

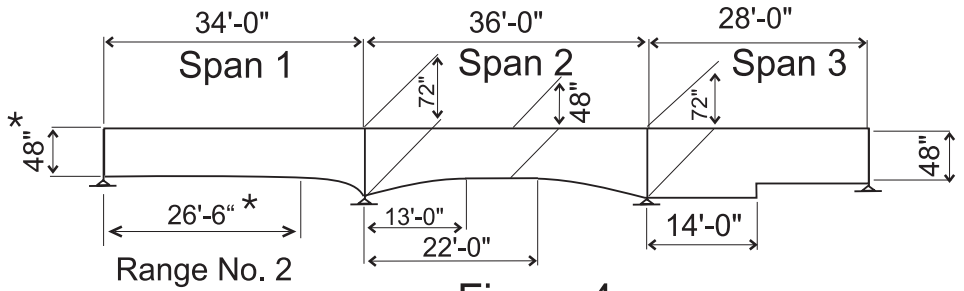


Figure 4

* Note: Range No. 1 is zero feet and D_1 and D_3 is 48"

470	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	SPAN-B	SPB
PURPOSE	This is the second in a series of commands defining each span of a structure. The longitudinal dimensions of each span, beginning and ending points of typical cross sections and web depth variation are entered. The first parameter of the SPAN-B command is required for web depth cases 2, 3, & 4. The remaining parameters are used as needed to fully describe web depth cases 2, 3, & 4. The SPAN-B command may be used up to five times as necessary.	

6 COMMAND PARAMETERS	
D_3 (also D_6, D_9, D_{12}, D_{15})	Enter the next web depth in inches at the right end of web range #1. See D_3 in Figure 1.
Range #2 (also R_5, R_8, R_{11}, R_{14})	Enter the length in feet of web range #2. See Range #2 in Figure 1. Not required if Range #2 equals span length.
D_3 or D_4 (also D_7, D_{10}, D_{13}, D_{16})	Enter the next web depth in inches at the right end of web range #2. If web case equals 2 or 3 enter D_3. If web case equals 4, enter D_4. See Figure 1.
Range #3 (also R_6, R_9, R_{12})	Web case 4 only. Enter the length in feet of web range #3. Not required if Range #3 equals span length. See Figure 1, web case 4.
D_5 (also D_8, D_{11}, D_{14})	Web case 4 only. Enter the next web depth in inches at the right end of web range #3. See D_5 in Figure 1.
Range #4 (also R_7, R_{10}, R_{13})	Web case 4 only. Enter the length in feet of web range #4. Not required if Range #4 equals span length. See Figure 1, web case 4.

EXAMPLE

The example shown in Figure 4 will also be used for the example in the SPAN-A Command. The SPAN-B Command would be coded as shown in bold print:

COM Span 1 series
SPAN-A 1, 34, 3, 48, 72, 0
SPAN-B 48, 26.5, 48
COM
COM Span 2 series
SPAN-A 2, 36, 3, 72, , 13
SPAN-B 48, 22, 48
COM
COM Span 3 series
SPAN-A 3, 28, 4, 72, 48, 14
SPAN-B 48

FIGURES

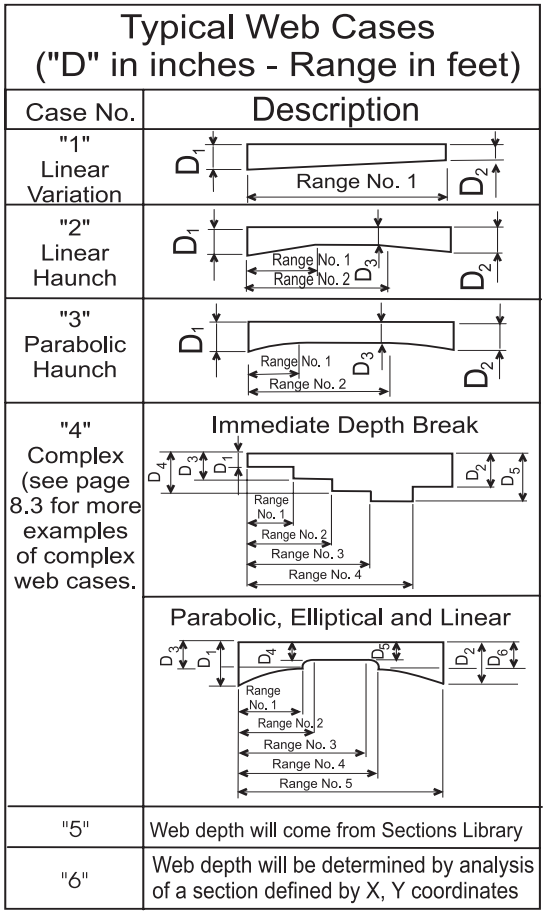
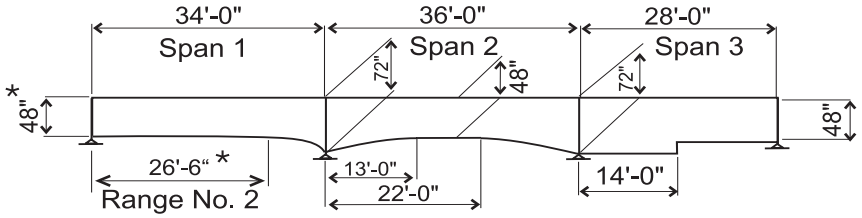


Figure 1



Note: Range # 1 is 0

Figure 2

475	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	SPAN-RANGE	SPR
PURPOSE	The purpose of this command is to control the type of web depth variation between span ranges defined with the SPAN-A and SPAN-B commands when web case 4 is selected. This command is optional if only immediate breaks are desired.	

14 COMMAND PARAMETERS

Web Depth Variation between left end of span and the end of Range 1 Default = Blank (Immediate Break)	For each parameter below, enter the appropriate code: Code — Web Depth Variation 1 — Linear Variation 2 — Elliptical Variation, Concave Down 3 — Parabolic Variation, Concave Down 4 — Elliptical Variation, Concave Up 5 — Parabolic Variation, Concave Up See Figures and Notes.
Web Depth Variation between the end of Range 1 and the end of Range 2 Default = Blank (Immediate Break)	
Web Depth Variation between the end of Range 2 and the end of Range 3 Default = Blank (Immediate Break)	
Web Depth Variation between the end of Range 3 and the end of Range 4 Default = Blank (Immediate Break)	
Web Depth Variation between the end of Range 4 and the end of Range 5 Default = Blank (Immediate Break)	
Web Depth Variation between the end of Range 5 and the end of Range 6 Default = Blank (Immediate Break)	
Web Depth Variation between Range 6 and the end of Range 7 Default = Blank (Immediate Break) (Continued)	

COMMAND PARAMETERS (con't)	
Web Depth Variation between the end of Range 7 and the end of Range 8 Default = Blank (Immediate Break)	
Web Depth Variation between the end of Range 8 and the end of Range 9 Default = Blank (Immediate Break)	
Web Depth Variation between the end of Range 9 and the end of Range 10 Default = Blank (Immediate Break)	
Web Depth Variation between the end of Range 10 and the end of Range 11 Default = Blank (Immediate Break)	
Web Depth Variation between the end of Range 11 and the end of Range 12 Default = Blank (Immediate Break)	
Web Depth Variation between the end of Range 12 and the end of Range 13 Default = Blank (Immediate Break)	
Web Depth Variation between the end of Range 13 and the end of Range 14 Default = Blank (Immediate Break)	

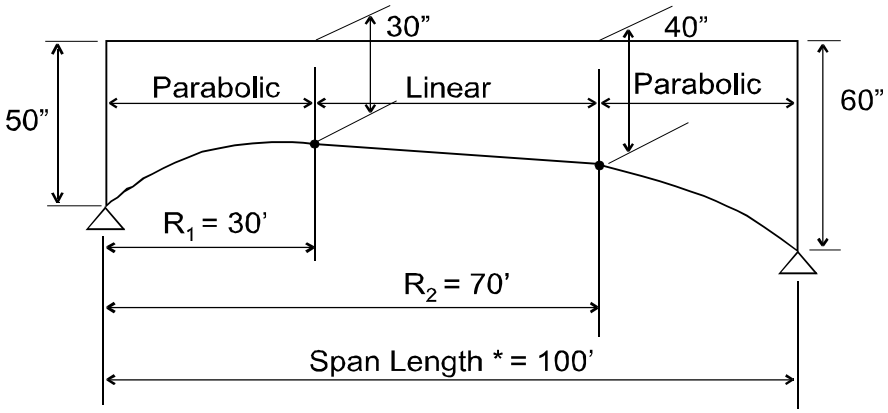
EXAMPLE

For the figure shown below, the values for R_1 and R_2 were input, and the program sets the value for R_3. Code the SPAN-RANGE command as follows:

```
SPAN-A      1,  100,    4,    50,    60,    30
SPAN-B      40,  70
SPAN-RANGE  3,      1,    3,
```

Note: This is similar to the Web Case 3 but Web Case 4 is needed to describe two different web depths at each end of the linear section.

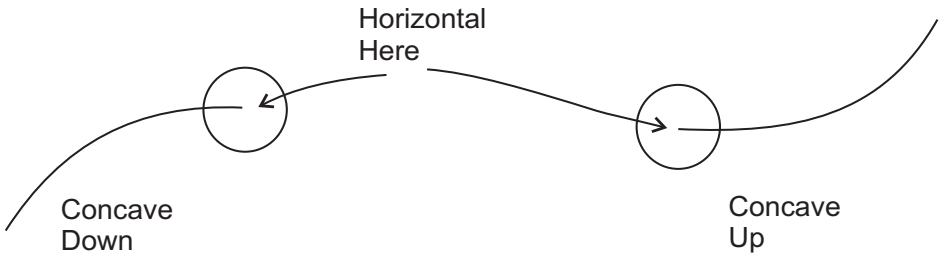
FIGURES



* Not input as a range

NOTES

End of span range = last range used + 1



Special Cases for Parabolic Web Variations.

There are several conditions involving parabolic web variation that must be noted for parabolas that are concave down.

If a parabola is concave down and a line joining the ends of the parabola slopes down to the right the following conditions apply:

1. If the range to the left of the parabola is linear and slopes down to the right, the parabola will be adjusted so that the left end of the parabola is tangent to the slope of the linear range.
2. If one or more ranges to the right are also parabolic and a line joining the ends of the parabolas slopes down to the right, the parabolas will be combined into one parabola automatically. If the end points of the original parabolas do not fall on the new parabola, an error will occur. The user is responsible to insure that multiple parabolas can be combined into one.

If a parabola is concave down and a line joining the ends of the parabola slopes up to the right the following conditions apply:

1. If the range to the right of the parabola is linear and slopes up to the right, the parabola will be adjusted so that the right end of the parabola is tangent to the slope of the linear range.
2. If one or more ranges to the right are also parabolic and a line joining the ends of the parabolas slopes up to the right, the parabolas will be combined into one parabola automatically. If the end points of the original parabolas do not fall on the new parabola, an error will occur. The user is responsible to insure that multiple parabolas can be combined into one.

480	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	SPAN-C	SPC
PURPOSE	This is the third in a series of commands defining each span of a structure. The longitudinal dimensions of each span, beginning and ending points of typical cross sections and web depth variation are entered. The SPAN-C command is required for all spans. Its purpose is to define changes in typical cross section along the span.	

4 COMMAND PARAMETERS

SLT	Enter the cross section number representing the typical cross section at the left end of the span. This number must correspond to a cross section number defined by either XSECT-STD, XSECT-A through XSECT-H, or XSECT-COORD1 and XSECT-COORD2 commands. If the cross section is circular, code 101 and no further data will be required for this span. See Figure 1.
R_1	Enter the distance in feet from the left end of the span to the first point on the span where the cross section changes. If there are no changes in cross section, enter the span length. See R_1 in Figure 1. **Note:** When describing a prestressed concrete girder, a constant cross section may be required between supports except for changes to the composite concrete deck dimensions and/or composite concrete deck reinforcing steel. End blocks will affect the neutral axis location and may cause incorrect end moments to be applied to the beam. This problem will occur when the end of the development length + debond length falls within the end block. If omission of the end block creates a low shear capacity, a second analysis may be performed with the end block in place. Another option would be to increase the % of the concrete in shear in the region of the end block based on the area of the additional concrete. See the STIRRUP-SCHEDULE command, parameter 6. If the end block section is omitted, the additional weight of the concrete due to the end block may be applied using the LOAD-DESCR and UNIFORM-DL1 commands.
SL_1 Default = SLT	Enter the cross section number representing the cross section on the left of the first cross section change point. If this cross section number is not the same as SLT, BRASS will vary all cross section properties linearly from 0 feet to R_1 (including web thickness but not web depth - web depth variation is defined by the SPAN-A and SPAN-B commands). This is typical of all ranges between cross section change points. See SL_1 in Figure 1.
SR_1 Default = SL_1	Enter the cross section number representing the cross section on the right of the first cross section change point. If there is no immediate change at this point but the cross section begins to taper to the next change point or to the end of the span, leave this parameter blank. This parameter is not required if R_1 equals the span length.

EXAMPLE

For the example structure shown below in Figure 2, the SPAN commands would be coded as follows:

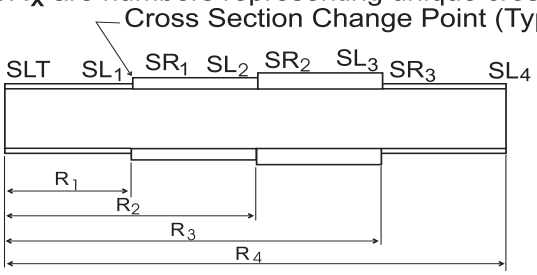
```
SPAN-A    1,    30,    1,          32
SPAN-C    1,    24,    1,          2
SPAN-D    30,   2

SPAN-A    2,    30,    1,          32
SPAN-C    2,    6,     2,          3
SPAN-D    24,   3,     2,          30,    2

SPAN-A    3,    30,    1,          32
SPAN-C    2,    6,     2   Blank because section tapers to next change point.
SPAN-D    14,   1,     1,    30,   1
```

FIGURES

SLT, SL_x & SR_x are numbers representing unique cross sections.



Note:
1) The last range must equal the span length.
2) SL = Section Number left of change point x.
3) SR_x = Section Number right of change point x.
4) SLT_x = Section Number at left end of span.
5) Maximum number of ranges allowed in one span is 40.
6) Cross Sections defined by elements may taper between change points. Cross sections containing a standard section (with or without cover plates) may not taper.
7) All dimensions are in feet.

TYPICAL CROSS SECTIONS RANGES
Figure 1

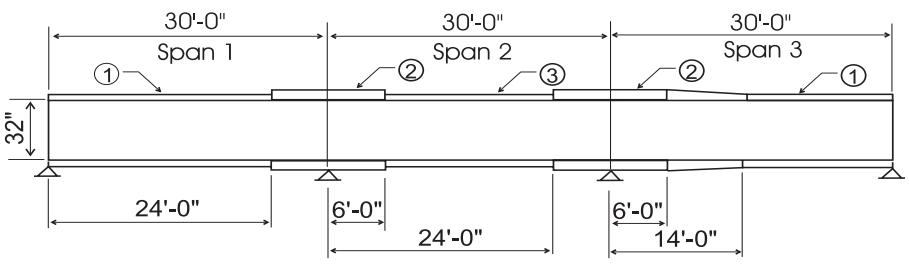
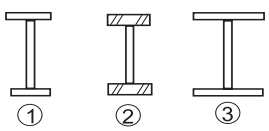


Figure 2



490	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	SPAN-D	SPD
PURPOSE	This is the fourth in a series of commands defining each span of a structure. The longitudinal dimensions of each span, beginning and ending points of typical cross sections and web depth variations are entered. The SPAN-D command is required for spans having one or more cross section change points. It may be repeated as needed to define up to a maximum of 40 change points.	
6 COMMAND PARAMETERS		
R_X x = number of change point	Enter the distance (range) in feet from the left end of the span to cross section change point x (next one from left). See R_2 in Example and Figure 1.	
SL_X	Enter the cross section number representing the typical cross section on the left of the first cross section change point. See SL_2 in Example and Figure 1.	
SR_X Default SL_X	Enter the cross section number representing the typical cross section on the right of the cross section change point. See SR_2 in Example and Figure 1. If there is no immediate change at this point but the cross section begins to taper to the next change point or end of the span, leave this parameter blank. This parameter is not required if R_X equals the span length.	
R_X x = number of change point	Enter the distance (range) in feet from the left end of the span to cross section change point x (next one from left). See R_3 in Example and Figure 1.	
SL_X	Enter the cross section number representing the typical cross section on the left of the first cross section change point. See SL_3 in Example and Figure 1.	
SR_X Default SL_X	Enter the cross section number representing the typical cross section on the right of the cross section change point. See SR_3 in Example and Figure 1. If there is no immediate change at this point but the cross section begins to taper to the next change point or end of span, leave this parameter blank. This parameter is not required if R_X equals the span length.	

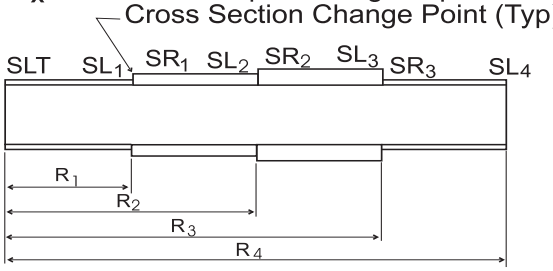
EXAMPLE

For the example span shown below in Figure 2 the SPAN-D command would be ended as follows: NOTE: The SPAN-C command is also shown to illustrate how the two would correlate:

```
SPAN-C     1,     12,     1,     2
SPAN-D    22,      2,     3,    32,     3,     4
SPAN-D    42,      4,     5,    52,     5,     6
SPAN-D    62,      6,     7,    72,     7,     8
SPAN-D    90,      8
```

FIGURES

SLT, SL_X & SR_X are numbers representing unique cross sections.



Note:
1) The last range must equal the span length.
2) SL = Section Number left of change point x.
3) SR_X = Section Number right of change point x.
4) SLT_X = Section Number at left end of span.
5) Maximum number of ranges allowed in one span is 40.
6) Cross Sections defined by elements may taper between change points. Cross sections containing a standard section (with or without cover plates) may not taper.
7) All dimensions are in feet.

TYPICAL CROSS SECTIONS RANGES
Figure 1

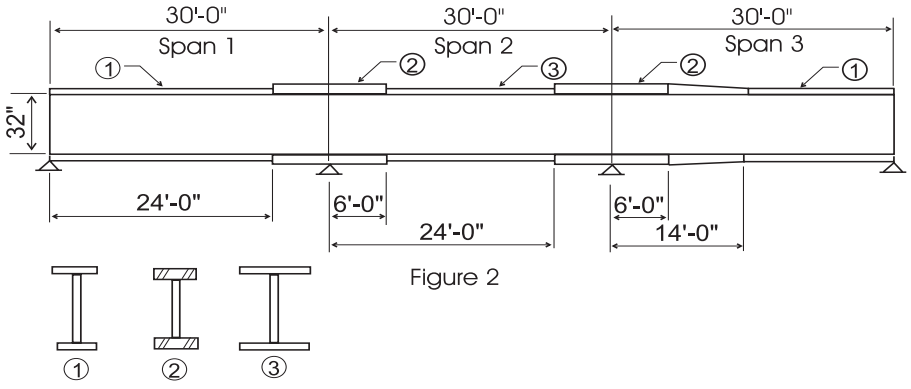
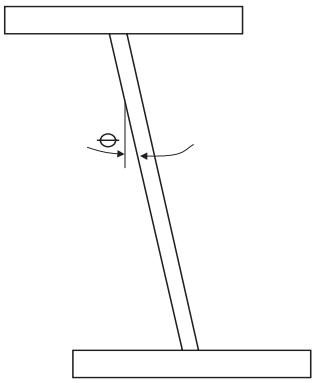


Figure 2

492	BRASS-GIRDER™	COMMAND DESCRIPTION	
COMMAND NAME		**STEEL-GIRDER-CONTROL**	**SGC**
PURPOSE		Use to define control parameters for spans on a steel girder structure. This command is required when inputting data for analysis points using schedule based input. The data entered on this command will be used in the generation of point of interest commands for steel girders. Repeat as needed for up to 50 ranges.	
10 COMMAND PARAMETERS			
Span Number		Enter the span number.	
Start Distance		Enter the distance, in feet, from the left end of the span to the start of the range for which the following control parameters are to apply.	
Range Length		Enter the range length, in feet, for which the following control parameters are to apply.	
Section Type Default = 2		Enter one of the following codes to describe the type of steel girder at this analysis point (see Notes): 2 = Non-composite rolled or welded steel girder. 3 = Riveted. See Note, STEEL-2 command. 4 = Composite steel & concrete section where dead load moment is positive (tension in bottom of section). See Note 1. 5 = Composite steel and concrete section where the dead load moment is negative (tension in top of the section). See Note 1. 41 = The steel girder cross section at this point may be compact and the girder cross sections at the adjacent pier(s) are compact or moment released (i.e. hinge or pin connected) and you desire the program to check AASHTO Equation 10-129b and 10-129c. If you want the section at this point to be analyzed as non-compact, code 4. See Note 2.	
(Continued)			

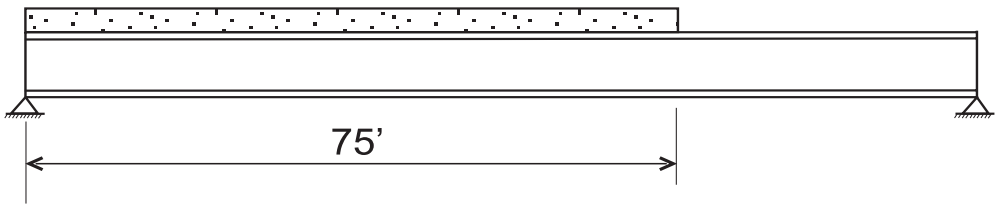
COMMAND PARAMETERS (con't)	
Web Angle Default = 0.0	Enter the angle θ in degrees if the web is not vertical. 
Allowable Fatigue Stress Default = 1×10^{10} (The default allows the user to remove it from rating, if desired)	Enter the allowable fatigue stress in ksi. Ultimate Strength Design/Rating only.
Operating Rating Based on Serviceability Default = 0	Enter 1 if LFD operating rating check for steel girders for serviceability is to be skipped.
C_b - For Positive Bending Moment Default = Computed Using AASHTO 10.48.4.1	This parameter allows the user to override the calculation of C_b for positive bending moment.
C_b - For Negative Bending Moment Default = Computed Using AASHTO 10.48.4.1	This parameter allows the user to override the calculation of C_b for negative bending moment.
Girder Type Default = 2 Required entry for a rolled beam girder when a bearing stiffener analysis is desired.	Enter the code below for the type of girder at the point of bearing. 1 = Rolled Beam 2 = Welded Plate

EXAMPLE

Span 1 of a bridge is 100' long. It is composite from the left end to 75' from the left end. The STEEL-GIRDER-CONTROL command would be used as follows:

```
STEEL-GIRDER-CONTROL    1,    0,    75,   4,    ,
STEEL-GIRDER-CONTROL    1,    75,   25,   2,    ,
```

FIGURES



NOTES

1. To determine whether to use option 4 or 5 for the type of steel girder, refer to the typical cross section defined at this point. If the cross section includes the composite slab in the calculation of the moment of inertia of the section, enter 4 (see Note 2 below). If negative moment occurs at this point, the concrete slab will be in tension and the moment of inertia will be in error. BRASS will print a message explaining the condition and action taken.

If the cross section is composite and does include slab reinforcement, enter 5 (see Note 2 below). If positive moment occurs, the concrete slab will be in compression and the moment of inertia will be in error. BRASS will print a message explaining the condition and action taken.

Please refer to AASHTO 10.50.1.1.2

2. The following does not apply to hybrid girder sections:

Code 41 if the girder cross section at this point may be compact and the girder cross sections at the adjacent pier(s) are compact or moment relieved (i.e. hinge or pin connected) and you desire the program to check AASHTO Equation 10-129b and 10-129c. If you want the section at this analysis point to be analyzed as non-compact, code 4. Suggestion: BRASS may be run with the pier points coded (the 200, 300, 400, points, etc.) with the intermediate output turned on to see if the sections at those points are compact.

Also note that compactness is a function of loading and load factors, hence compactness is not always simple to determine. If BRASS is run to establish compactness, the engineer should revise all (or the appropriate) load cases and levels by reviewing the intermediate output for the pier sections.

493	BRASS-GIRDER™	COMMAND DESCRIPTION	
COMMAND NAME		**STIF-TRAN-SCHEDULE**	**STS**
PURPOSE		Use to define the ranges and spaces for transverse stiffener groups along the length of a span. Repeat as needed for up to 50 ranges.	
5 COMMAND PARAMETERS			
Span Number		Enter the span number.	
Stiffener Group Number		Enter the stiffener group number for this range. The number must be defined with the STIF-TRAN-GROUP command.	
Spacing		Enter the spacing, in inches, between the transverse stiffeners in this range.	
Start Distance		Enter the distance, in feet, from the left end of the span to the start of the transverse stiffener data described for this range.	
Range Length Default = Length to end of span		Enter the range, in feet, of the transverse stiffeners described by parameters 2 and 3.	

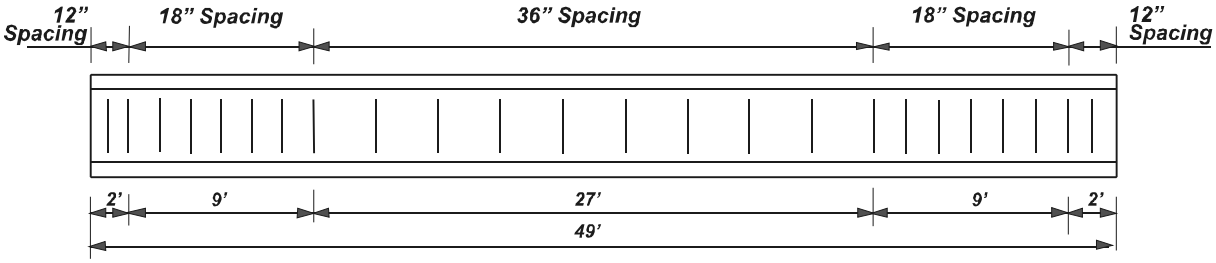
EXAMPLE

Given: A girder with various spaces of transverse stiffeners and with bearing stiffeners at each end (over the bearings). For span 1, with transverse stiffener group 1, and spaced at 12" o.c. over the first 2' of span, then 18" over the next 9', then 36" over the middle 27', then 18" over the next 9', and then 12" over the rest of the span, code as follows:

```
STIF-TRAN-SCHEDULE   1,    1,    12,   0,    2
STIF-TRAN-SCHEDULE   1,    1,    18,   2,    9
STIF-TRAN-SCHEDULE   1,    1,    36,   11,   27
STIF-TRAN-SCHEDULE   1,    1,    18,   38,   9
STIF-TRAN-SCHEDULE   1,    1,    12,   47,   2
```

For this example, BRASS-GIRDER **does not** specifically place a stiffener at the 12" point, 24" point, 42" point, etc. During the analysis, BRASS-GIRDER only knows that anywhere within the first 2' range, the minimum spacing is 12" and at the 2' point the maximum spacing is 18".

FIGURES



NOTES

The shear capacity of a section is determined, among other factors, by the spacing of stiffeners (refer to AASHTO). Stiffeners are spaced within a range. For a girder, range length must include all ranges in which it is desired to establish stiffener spacings. A range length must include that portion of a girder for which capacity incorporates transverse stiffeners; up to and including the end of the girder, even with bearing stiffeners. For those portions of a girder in which a range length of stiffeners has not been defined, capacity will be determined without stiffeners.

BRASS-GIRDER has a built in tolerance of 6". If a Point of Interest lies within 6" of a change point of transverse stiffener spacing, the program will use the maximum spacing at that change point. This is a conservative approach. For example, if you have a transverse stiffener at 80' on a 100' span and the first stiffener to the left of that point is 40 inches away and the first stiffener to the right of that point is 20 inches away, the shear strength will be computed for a 40" spacing. If a Point of Interest is located at 80' - 6" (which is within 6" of the stiffener change point), a 40" spacing will still be used.

494	BRASS-GIRDER™	COMMAND DESCRIPTION	
COMMAND NAME		**STIF-LONG-SCHEDULE**	**SLS**
PURPOSE		Use to define the longitudinal stiffener schedule along a span. Repeat as needed for up to 50 ranges.	
4 COMMAND PARAMETERS			
Span Number		Enter the span number.	
Longitudinal Stiffener Group Number		Enter the longitudinal stiffener group number for this range. The number must be defined with the STIF-LONG-GROUP command.	
Start Distance		Enter the distance, in feet, from the left end of the span to the start of the longitudinal stiffener being described.	
Longitudinal Stiffener Length Default =	Length to end of the span	Enter the length, in feet, of the longitudinal stiffeners being described.	

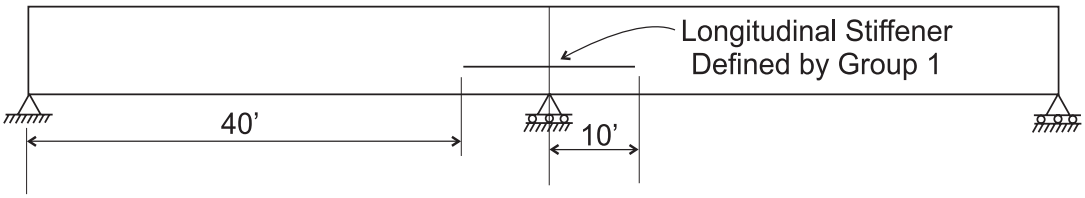
EXAMPLE

A 2-span structure has 150' spans and a longitudinal stiffener located over the interior support, 20' each side of the support. For longitudinal stiffener group code 1, code as follows:

```
STIF-LONG-SCHEDULE    1,    1,    130,    20

STIF-LONG-SCHEDULE    2,    1,    0,      20
```

FIGURES



NOTES

495	BRASS-GIRDER™	COMMAND DESCRIPTION	
COMMAND NAME		**BRACING-SCHEDULE**	**BRS**
PURPOSE		Use to define the schedule of cross bracing in a steel girder. This schedule will be used to determine the unbraced lengths at points of interest along the structure. Repeat as needed for up to 50 ranges.	
4 COMMAND PARAMETERS			
Span Number		Enter the span number.	
Spacing		Enter the spacing, in feet, of the cross bracing in this range.	
Start Distance		Enter the distance, in feet, from the left end of the span to the start of the spacing being described. See Notes.	
Range Length		Enter the length, in feet, of the range of the spacing being described. See Notes.	

EXAMPLE

For a 150' simple-span bridge with cross bracing located as shown in Figure 1, code as follows:

```
BRACING-SCHEDULE     1,     10,     0,     30
BRACING-SCHEDULE     1,     20,     30,    60
BRACING-SCHEDULE     1,     15,     90,    30
BRACING-SCHEDULE     1,     10,     120,   30
```

FIGURES

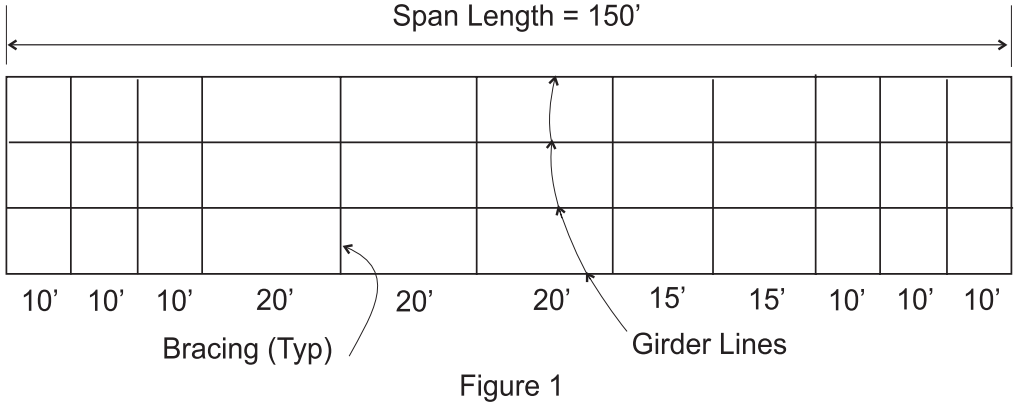


Figure 1

NOTES

BRASS assumes that girders will be braced at the top and bottom at supports (span ends). If the distance to the cross frame places the cross frame in an adjacent span, BRASS will use the distance to the span end. Additionally, if the point of support is the top of an integral column and the first cross frame is at the support with the column, code the distance to the cross frame as the distance to the span end, minus 0.1 feet. This is necessary so that BRASS will know whether to use the moment to the left or to the right of the support.

The first range must begin at 0.0 feet.

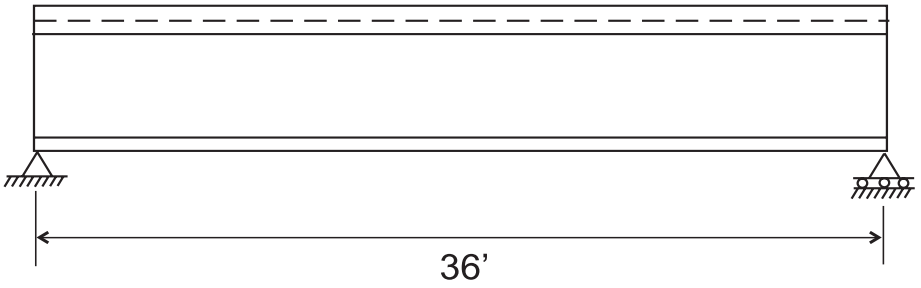
496	BRASS-GIRDER™	COMMAND DESCRIPTION	
COMMAND NAME		**LAT-SUPPORT-SCHEDULE**	**LTS**
PURPOSE		Use to define the schedule of lateral support of the top flange in a steel girder. This command indicates that the deck provides lateral support to the top flange over a specified range. This is generally used when portions of the top flange are embedded in the slab and thereby laterally supported. Repeat as needed for up to 50 ranges.	
3 COMMAND PARAMETERS			
Span Number		Enter the span number.	
Start Distance		Enter the distance, in feet, from the left end of the span to the start of the location where lateral support is provided.	
Range Length		Enter the length, in feet, of the range over which lateral support is provided.	

EXAMPLE

For rating a 36' simple-span non-composite bridge where the top flange is embedded in the deck which is assumed to provide lateral support to the top flange along the entire length of the girder, code as follows:

```
LAT-SUPPORT-SCHEDULE      1,    0,      36
```

FIGURES



NOTES

497	BRASS-GIRDER™	COMMAND DESCRIPTION	
COMMAND NAME		**STIRRUP-SCHEDULE**	**SIS**
PURPOSE		Use to define the stirrup schedule and other control data along a span. **NOTE**: The stirrup schedule based commands and other data may not be used when requesting allowable stress design ratings for reinforced concrete girders. Repeat as needed for up to 50 ranges. This command is required for each span if points of interest are to be generated (parameter 6 of the ANALYSIS command is coded non zero).	
11 COMMAND PARAMETERS			
Span Number		Enter the span number.	
Stirrup Group Number		Enter the stirrup group number for this range. The number must be defined with the command STIRRUP-GROUP. Code NA if there are no stirrups, as in the case of a slab bridge. See Note 2.	
Stirrup Spacing		Enter the longitudinal spacing, in inches, between the stirrups in this range.	
Start Distance		Enter the distance, in feet, from the left end of the span to the start of the range being described. See Note 3.	
Range Length		Enter the range length, in feet, of the stirrups being described. Default = Range to end of the span	
% Shear Default = See Note 1		NOTE: The following six parameters should only be used with the first STIRRUP-SCHEDULE command per span. See Example. Enter the percent of concrete section to be used in resisting shear normal to the member. This may be used in the rating of a concrete section for shear when the section is wholly or partially cracked.	
Axial Load Indicator Default = See Note 1		Enter 1 if axial load at this analysis point is to be ignored. This could apply in the case of a sidewall of a box culvert which is to be analyzed as a beam.	
Shear Indicator Default = See Note 1		Enter 1 if shear is to be ignored as in the case of a reinforced concrete slab bridge (see AASHTO 1.3.2(F)) or if prestressed girder shear is to be ignored. See Note 4.	
Lightweight Concrete Shear Factor Default = See Note 1		If the girder is constructed of reinforced concrete with lightweight aggregates, enter the shear factor for lightweight concrete (see AASHTO 8.15.5.2).	
V_{DIST}, Left End of Span Default = See Note 1		Enter the distance, in feet, from the centerline of the support to the shear face to be used for stirrup analysis at the left end of the span. See Figure 1 and Note 5.	
V_{DIST}, Right End of Span Default = See Note 1		Enter the distance, in feet, from the centerline of the support to the shear face to be used for stirrup analysis at the right end of the span. See Note 5.	

EXAMPLE

For stirrup group code 1 with a 6" spacing for the first 10' of span 2 and 12" spacing over the remainder of the span of 36', code as follows:

```
STIRRUP-SCHEDULE     2,  1,  6,  0,  10 ,   100,   ,   ,   1,  4, 4
STIRRUP-SCHEDULE     2,  1, 12, 10,  26
```

FIGURES

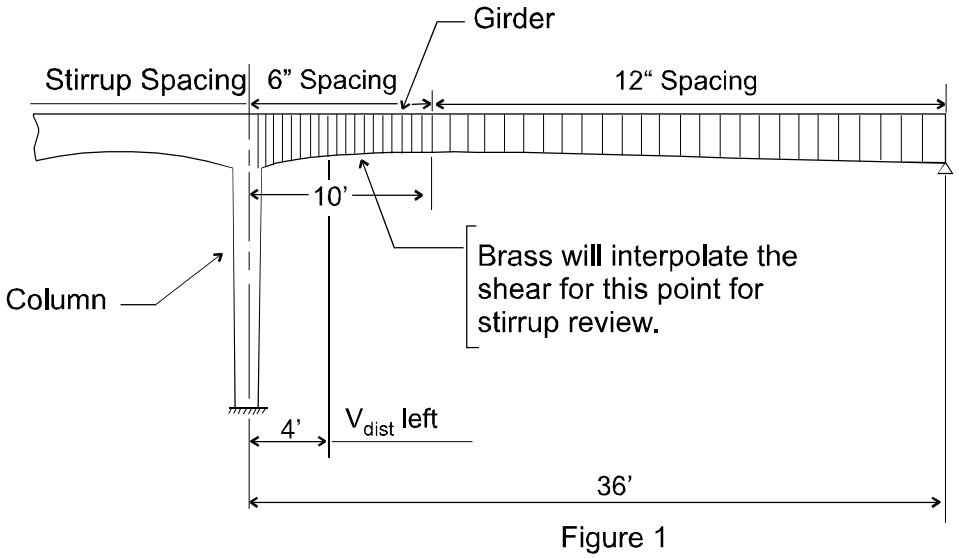


Figure 1

NOTES

1. This command may be repeated as needed for up to 50 times. The first time this command is used for each span, the user must enter values for all parameters (there are no defaults, therefore, in most cases, parameter 6 should be initially set to 100% and parameter 9 set to 1.0). When the command is repeated, the default values are taken from the parameters entered in the previous use of the command within the same data set.

2. When there are no stirrups, code the start distance as 0.0 and the range length equal to the span length so that parameters 6 thru 11 apply to the entire span. Include a STIRRUP-SCHEDULE command for each span.

3. When there are stirrups, the first range for a span should start at 0.0 feet. If the first range for the span does not start at 0.0 feet, parameters 6 through 11 will not be set for the span from 0.0 feet to the beginning of the first range. Ranges must be contiguous.

4. Ignoring shear can be used by range. For example, if you want to ignore shear in the first and last 2.0 feet of the span, code the first range from 0 to 2.0 feet and set the ignore shear indicator to 1. In the second range, set the shear indicator back to 0 (do not leave blank or it will default to 1). Then code the last range as 2.0 feet before the end of the span and set the shear indicator to 1.

5. These entries are intended for non-prestressed concrete girders only. If you want to have the program check prestress shear at 2.0 feet from the ends of the span instead of at the ends of the span, code the shear indicator as 1 as in Note 4 above, then using the POINT-OF-INTEREST command, code POIs at 2.01 feet from each end and use option 3 on the sixth parameter of the ANALYSIS command.

498	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	SPAN-COPY	SCP
PURPOSE	This is used to duplicate spans which are identical or symmetric to a span previously defined using the SPAN-A, SPAN-B, SPAN-C, and SPAN-D commands.	

3 COMMAND PARAMETERS	
New Span Number	Enter the new span number for which properties are to be generated.
Span Number to Copy	Enter the span number from which new span properties are to be generated.
Symmetric Span Flag Default = 0	If the new span to be generated is symmetric from the span being copied, enter a 1. If the span is the same, enter 0.

EXAMPLE

For a 2-span structure with Span-2 being the mirror image of Span-1, the BRASS commands coded to define each span would be coded as follows:

```
SPAN - A          1,    92.25,    5
SPAN - C          1,     7.50,    1,     2                        SPAN 1
SPAN - D      69.50,        2,    3,  81.5,    3,    4
SPAN - D      92.25,        4
FIXITY            1,        1,    0,     0,    1,    0

SPAN-COPY         2,        1,    1                              SPAN 2
FIXITY            0,        1,    0,     0,    1,    0
```

FIGURES

NOTES

1. Default fixity is assumed at each end unless the FIXITY command is input. Also, any user defined boundary springs, support settlements, or hinge locations need to be redefined for the new span using the appropriate commands.

500	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	FIXITY	FIX
PURPOSE	This is the fifth in a series of commands defining each span of a structure. This command describes the end conditions of a span. It is required for each span unless the defaults are all appropriate. Note: spans are described from Left to Right or from top to bottom.	

6 COMMAND PARAMETERS	
Horizontal Left or Top End Restraint Default = 1	Code 1 if the left end of the span is restrained against horizontal movement. Code 0 if the left end is free to move horizontally. If left blank it will default to 1. See Note 1.
Vertical Left or Top End Restraint Default = 1	Code 1 if the left end of the span is restrained against vertical movement. Code 0 if the left end is free to move vertically. If left blank, it will default to 1. See Note 1.
Rotational Left or Top End Restraint Default = 0	Code 1 if the left end of the span is restrained against rotation. Code 0 if the left end is free to rotate. If left blank it will default to 0. See Note 1.
Horizontal Right or Bottom End Restraint Default = 0	Code 1 if the right end of the span is restrained against horizontal movement. Code 0 if the right end is free to move horizontally. If left blank it will default to 0. See Note 1.
Vertical Right or Bottom End Restraint Default = 1	Code 1 if the right end of the span is restrained against vertical movement. Code 0 if the right end is free to move vertically. If left blank it will default to 1. See Note 1.
Rotational Right or Bottom End Restraint Default = 0	Code 1 if the right end of the span is restrained against rotation. Code 0 if the right end is free to rotate. If left blank it will default to 0. See Note 1.

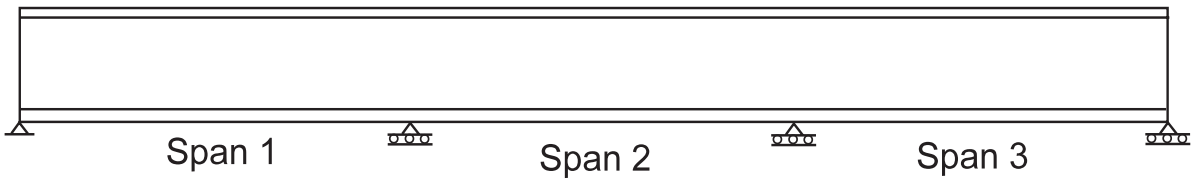
EXAMPLE

For the conditions of end restraint shown below in Figure 1, the FIXITY command would be coded as follows:

```
SPAN-A .....
SPAN-B .....
:
FIXITY    1,    1,    0,    0,    1,    0      For span 1 series
SPAN-A .....
SPAN-B .....
:
FIXITY    0,    1,    0,    0,    1,    0      For span 2 series
SPAN-A .....
SPAN-B .....
:
FIXITY    0,    1,    0,    0,    1,    0      For span 3 series
```

See Note 2.

FIGURES



NOTES

1. For a structure with integral legs (i.e., a “K” bridge - See Figure 1, Page 10.4, BASIC STRUCTURE), using spans 7 through 13, the fixity at the top of the span would be coded 0, 0, 0.

2. If defaults were taken for the above example the FIXITY commands would be as follows:

```
not required        For span 1 series

FIXITY 0            For span 2 series

FIXITY 0            For span 3 series
```

The fixity at a span end or joint need only be defined once.

505	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	FIX-SPRING	FIS
PURPOSE	This is the sixth in a series of commands defining each span of a structure. This command may be used to define spring constants of springs restraining supports. This allows the modeling of elastic supports. Spring constants can be applied to supports fixed by a 1 in the FIX command.	

6 COMMAND PARAMETERS	
Horizontal left End Spring Constant Default = ∞ *	Enter the spring constant in Kips/in. of the imaginary spring restraining the left end of the span from horizontal movement.
Vertical left End Spring Constant Default = ∞ *	Enter the spring constant in Kips/in. of the imaginary spring restraining the left end of the span from vertical movement.
Rotational left End Spring Constant Default = ∞ *	Enter the spring constant in In.Kips/radian of the imaginary spring restraining the left end of the span from rotational movement.
Horizontal right End Spring Constant Default = ∞ *	Enter the spring constant in Kips/in. of the imaginary spring restraining the right end of the span from horizontal movement.
Vertical right End Spring Constant Default = ∞ *	Enter the spring constant in Kips/in. of the imaginary spring restraining the right end of the span from vertical movement.
Rotational right End Spring Constant Default = ∞ * * See note:	Enter the spring constant in In.Kips/radian of the imaginary spring restraining the right end of the span from rotational movement.

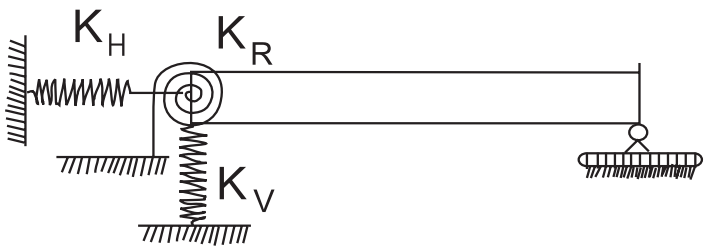
EXAMPLE

Assume that the abutments of a two span bridge are setting on elastic soil with a modulus of 50 tons per inch. This situation could be modeled by using the FIX-SPRING command in the span series:

```
 Span 1
FIXITY                1,      1,     0,     0,     1,    0
FIX-SPRING            ,     100

 Span 2
FIXITY                      0,     1,     0,     0,    1,          0
FIX-SPRING            ,     ,      ,      ,     100
```

FIGURES



NOTES

A support restraint must be "fixed" if it is to be modeled with a spring.

Default = ∞ if restrained.

507	BRASS-GIRDER™	COMMAND DESCRIPTION	
COMMAND NAME		**STIF-BEAR-SCHEDULE**	**SBS**
PURPOSE		Use to define the bearing stiffener schedule for supports. This command may be repeated as needed for up to 26 times.	
2 COMMAND PARAMETERS			
Support Point		Enter the support point (100, 110, 200, 210, 300, 310, etc.)	
Stiffener Group Number		Enter the stiffener group number for this range. The number must be defined with the STIF-BEAR-GROUP command.	

EXAMPLE

For a 3-span structure with similar bearing stiffeners at exterior supports (group 1) and similar bearing stiffeners at interior supports (group 2), code as follows:

```
SPAN-A                  1,    55.125,      5
SPAN-C                  1,    55.125
FIXITY 1, 1, 0, 0, 1, 0
STIF-BEAR-SCHEDULE      100,  1
SPAN-A                  2,    70.000,      5
SPAN-C                  1,    70.000
FIXITY 0, 1, 0, 0, 1, 0
STIF-BEAR-SCHEDULE      200,  2
SPAN-A                  3,    55.125,      5
SPAN-C                  1,    55.125
FIXITY 0, 1, 0, 0, 1, 0
STIF-BEAR-SCHEDULE      300,  2
STIF-BEAR-SCHEDULE      310,  1
```

FIGURES

NOTES

510	BRASS-GIRDER™	COMMAND DESCRIPTION

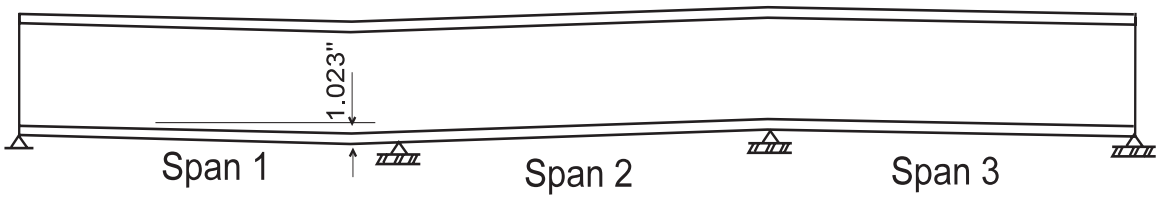
COMMAND NAME	SETTLEMENT	SET
PURPOSE	This is the seventh in a series of commands defining each span of a structure. This command describes given translations of a span end. The most general use would be to evaluate the effect of pier or abutment settlement on the structure. This command is optional.	
6 COMMAND PARAMETERS		
Left end horizontal movement	Enter the movement in inches of the left end of the span horizontally (parallel to x axis). Movement to the right is positive, movement to the left is negative.	
Left end vertical movement	Enter the movement in inches of the left end of the span vertically (parallel to y axis). Movement downwards is positive, movement upwards is negative.	
Left end rotational movement	Enter the rotational movement in degrees of the left end of the span. Clockwise rotational movement is positive, counterclockwise is negative.	
Right end horizontal movement	Enter the movement in inches of the right end of the span horizontally (parallel to x axis). Movement to the right is positive, movement to the left is negative.	
Right end vertical movement	Enter the movement in inches of the right end of the span vertically (parallel to y axis). Movement downwards is positive, movement upwards is negative.	
Right end rotational movement	Enter the rotational movement if degrees of the right end of the span. Clockwise rotational movement is positive, counterclockwise is negative. See Notes.	

EXAMPLE

For the condition of settlement shown below in Figure 1, the SETTLEMENT command would be entered once in the span 1 series. It would not need to be entered again for the span 2 series of commands.

SETTLEMENT , , , , 1.023 Span 1 series.

FIGURES



NOTES

The settlement at a span end or joint need only be defined once. However, you must code the support settlement when it is first encountered when moving left to right. Thus, in the example shown above, the settlement command would be input after the FIXITY command for span 1 only.

BRASS-GIRDER™ applies settlement and temperature loads to the structure and calculates the resulting actions. The load effects are printed as separate load cases and are combined with dead load actions for the calculation of stresses with the same load factors as applied to dead load. If the user desires a different load factor for settlement and/or temperature, multiply the settlement (temperature) by that factor prior to input.

520	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	HINGE	HNG
PURPOSE	This is the eighth and last in a series of commands defining each span of a structure. This command describes the location of hinges and special analysis points (node points) in a span. Up to two hinges and/or two special analysis points are allowed per span using this command. If additional special analysis points are needed, use the TRANSFER command. This command is optional.	

4 COMMAND PARAMETERS

1st Hinge	Enter the distance in feet from the left end of the span to the first hinge in the span. See Figure 1 & Note.
2nd Hinge	Enter the distance in feet from the left end of the span to the second hinge in the span. See Figure 1 & Note.
1st Special Analysis Point	BRASS automatically creates node points at locations needed to perform analysis. To obtain properties or actions and displacements at some point other than those, enter the distance in feet from the left end of the span to that point. See Figure 1.
2nd Special Analysis Point	Enter the distance in feet from the left end of the span to the second special analysis point. See Figure 1.

EXAMPLE

For the span shown below which contains one hinge and two special analysis points, the HINGE command would be coded as follows:

HINGE 35, , 16.3, 22

FIGURES

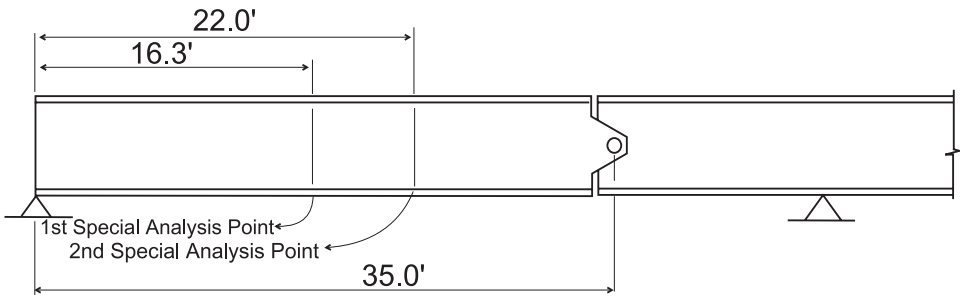


Figure 1

NOTES

Hinges may not be placed at span ends, but may be positioned at a point greater than 0.12 feet either side of a support. This will produce basically the same effect. Two hinges may not be put at a support.

11. MATERIAL PROPERTIES

The PROPERTIES-xxxx commands are used as needed to describe the material properties of the girders. Only those commands pertaining to the type of material are required unless the command parameter defaults are OK.

Prestressing strand properties are described in the STRAND-xxxx command set.

530	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PROPERTIES-ST1	PS1
PURPOSE	This command is used to define material properties of steel or steel and concrete composite girders. If the default values are satisfactory, then this command may be omitted.	

4 COMMAND PARAMETERS

Unit Weight Default = 490 pcf	Enter the unit weight of the steel used in the girder in lbs. per cubic foot.
E_S Default = 29000 ksi	Enter the modulus of elasticity of the girder material in kips per square inch.
f'_C Default = 4 ksi	Enter the breaking strength of the composite concrete at the time desired. Usually this is the 28 day test strength. Enter in kips per square inch.
f_Y Splice Plates Default = 36.0 ksi	*Use the following parameter only when designing a splice. Enter the yield strength of the splice plate material in kips per square inch.

EXAMPLE

PROPERTIES-ST1 , , 3.250

This will give a unit weight of steel of 490 lbs. per cubic foot with a modulus of elasticity of 29000 ksi and composite concrete with 3.250 ksi breaking strength.

FIGURES

NOTES

540	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PROPERTIES-ST2	PS2
PURPOSE	This command defines the material properties for composite steel and concrete girders. If the default values are satisfactory then the command may be omitted	

3 COMMAND PARAMETERS

n Default = 8	Enter the ratio of the modulus of elasticity of steel to the modulus of elasticity of concrete, n, for the calculation of composite girder properties for short term loadings (live load).
$n_{SUSTAINED}$ Default = 3 n	Enter the ratio of the modulus of elasticity of steel to the modulus of elasticity of concrete, $n_{SUSTAINED}$, for the calculation of composite girder properties for long term (sustained) loadings.
f_Y Default = 60 Ksi	Enter the yield strength in kips per square inch of reinforcing steel in the composite slab that will provide additional negative moment capacity to the section.

EXAMPLE

PROPERTIES-ST2 10, 30, 40

for n= 10

n_{SUST} = 30

f_Y = 40 ksi

FIGURES

NOTES

550	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PROPERTIES-RC	PRC
PURPOSE	This command defines the material properties for a reinforced concrete girder. This command is always required for reinforced concrete structures.	

6 COMMAND PARAMETERS

Unit Weight Default = 150 pcf	Enter the unit weight of the reinforced concrete used in the girder in lbs per cubic foot.
E_C Defaults to AASHTO 8.7	Enter the modulus of elasticity of the girder concrete in kips per square inch. See Notes.
n Default = 8	Enter the ratio of the modulus of elasticity of the reinforcing steel to the modulus of elasticity of the girder concrete.
f'_C Default = 4 ksi	Enter the breaking strength of the girder concrete at the time desired. Usually this is the 28 day test strength. Enter in kips per square inch.
f_Y Default = 60 ksi	Enter the specified yield stress of the steel reinforcement used in the reinforced concrete girder in kips per square inch.
f_{YS} Default = 40 ksi	Enter the specified yield stress of the reinforcing steel used for stirrups in the reinforced concrete girder in kips per square inch.

EXAMPLE

PROPERTIES-RC 150, 3000, 10, 3.250, 40, 40

For:
Unit weight of concrete = 150 lbs. per cubic foot.
E_C = 3000 ksi
E_S/E_C = 10

f'_C = 3.250 ksi
f_Y = 40 ksi for main reinforcement
f_{YS} = 40 ksi for stirrups

FIGURES

NOTES

The Unit Weight of concrete used to calculate E_C when the default is used equals the Unit Weight (defined in parameter #1) minus 5 lbs. to account for the reinforcing steel.

560	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PROPERTIES-RCB	PCB
PURPOSE	This command defines properties for the concrete in the bottom of a reinforced concrete girder. This command is only required when the concrete strengths of the top and bottom of the girder are different when using ultimate strength analysis. Corresponding value for the top should be input with the PROPERTIES-RC command.	

2 COMMAND PARAMETERS

f'_C	Enter the breaking strength of the concrete in the bottom of the girder at the time desired. Usually this is the 28 day test strength. Enter in kips per square inch.
n - Bottom	Enter the ratio of the modulus of elasticity of the reinforcing steel to the modulus of elasticity of the concrete in the bottom of the girder.

EXAMPLE

Assume a reinforced concrete T-girder is composed of two different strengths of concrete. The concrete in the flange has a compressive strength of 4 ksi and the concrete in the stem has a compressive strength of 3.25 ksi. For the bottom, $E_S / E_C = 9$.

```
PROPERTIES - RCB   3.25,  9
```

FIGURES

NOTES

The compressive strength in the flange with the corresponding n value should be input with the PROPERTIES-RC command.

570	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PROPERTIES-TIM	PTM
PURPOSE	This command defines material properties for a timber girder. This command is required for only timber girders.	

5 COMMAND PARAMETERS

F_B Default = 1600	Enter the allowable unit stress in pounds per square inch for the extreme fiber in bending for structural lumber. (See Note 2.)
F_V Default = 85	Enter the allowable unit stress in pounds per square inch for horizontal shear for structural lumber. (See Note 2.)
F_C Default = 625	Enter the allowable unit stress in pounds per square inch for compression perpendicular to the grain for structural lumber. (See Note 2.)
Unit Wt. Default = 50	Enter the unit weight of the timber girder in lbs./cu. ft.
E_{TIM} Default = 1600	Enter the modulus of elasticity of timber girder material in ksi.

EXAMPLE

For "Select Structural Douglas Fir-Larch" enter:

PROPERTIES-TIM 2100, 95, 385

See Table 1.10.1A in AASHTO 1.10.1, 1989 with 1991 interims

FIGURES

NOTES

1. Defaults are based on Douglas Fir-Larch, Select Structural (West Coast Lumber Inspection Bureau) for beams and stringers with no correction for moisture, based on Wyoming conditions and deck of laminated 2" x 4" with asphalt cover.

2. Values entered for design stresses are assumed to contain all adjustment factors, as defined in AASHTO equations (13-2), (13-10) and (13-11).

580	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PROPERTIES-PC1	PC1
PURPOSE	This series of commands, (PROPERTIES-PC1 through PROPERTIES-PC5), in which this is the first, describes the properties of the prestressed, and non-prestressed concrete and the non-prestressed reinforcement. This command is always required for a prestressed concrete system.	

11 COMMAND PARAMETERS	
w Default (Prestressed concrete rating only) = 150 lbs./cu. ft.	Enter the unit weight of the girder concrete, w, in pounds per cubic foot. This value is used to calculate the weight of the girder for structural analysis.
f'_C Prestressed Default = 5.0 ksi	Enter the 28-day compressive strength of the prestressed concrete, f'_C, in kips per square inch.
f'_C Non-prestressed Default = 4.0 ksi	Enter the 28-day compressive strength of the non-prestressed concrete slab and diaphragms over the support, f'_C, in kips per square inch.
E_C Prestressed Default = AASHTO 8.7.1	Enter the modulus of elasticity of the prestressed concrete, E_C, in kips per square inch. See Note 1.
E_C Non-prestressed Default = AASHTO 8.7.1	Enter the modulus of elasticity of the non-prestressed concrete, E_C, in kips per square inch. See Note 1. Not used in prestressed concrete girder design.
f'_{CI} Default = 4.5 ksi	Enter the compressive strength of the prestressed concrete at the time of the initial transfer of stress from the prestressing steel to the concrete, f'_{CI}, kips per square inch.
E_C Prestressed at Time of Transfer Default = AASHTO 8.7.1	Enter the modulus of elasticity of the prestressed concrete at time of transfer of stress. See Note 1.
Box Beam Default = none	If this is a pretensioned box beam and diaphragms are cast integrally within the box, code 1. BRASS will add the weight of the diaphragms to the beam weight for calculating moment at release. Use load group 1 to enter the diaphragm weight.
Moment for f_{cir} (Continued)	Code 1 if moment used to determine f_{cir} (AASHTO 9.16.2.1.1) is to be based on the moment at the point of interest under consideration. Leave blank or 0 if the moment used for f_{cir} is to be based on the maximum moment in the span under consideration.

COMMAND PARAMETERS (Cont.)	
Distance for Positive Moment Strand Omit	Enter the distance in inches from the top of the girder for omitting strands for positive moment capacity determination. Enter 0 or blank if not desired. See Note 3 and Figure.
Distance for Negative Moment Strand Omit	Enter the distance in inches from the bottom of the girder for omitting strands for negative moment capacity determination. Enter 0 or blank if not desired. See Note 3 and Figure.

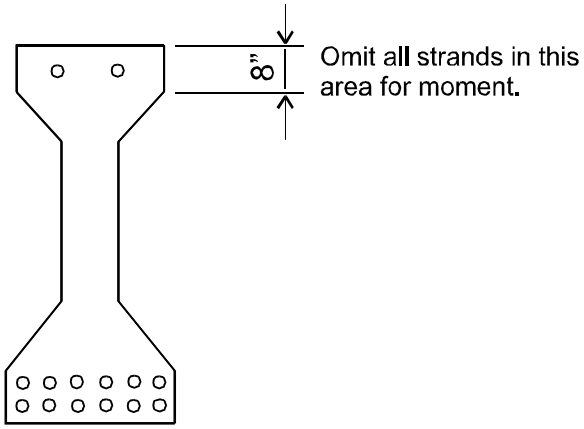
EXAMPLE

PROPERTIES-PC1 150, 5, 4, 4075, 3650, 4.5, 3865, , 1, 8

For:

Unit weight of concrete = 150 lb./cu. ft.
f'_C prestressed concrete = 5000 psi
f'_C non-prestressed concrete = 4000 psi
E_C prestressed concrete = 4075 ksi
E_C non-prestressed concrete = 3650 ksi
f'_{CI} prestressed concrete at time of initial transfer = 4500 psi
E_C prestressed concrete at time of transfer = 3865 ksi
Omit top strands for positive moment capacity (see figure).

FIGURES



NOTES

1) When parameters 4, 5, and 7 are not input, BRASS will calculate E_C using AASHTO equation 8.7.1 - $E_C = w^{1.5}\ 33\sqrt{f'_c}$. Values used for f'_C will default as follows:
   f'_C = Parameter 2 for prestressed concrete
   Parameter 3 for non-prestressed concrete
   Parameter 6 for prestressed concrete at time of transfer

2) The value of W (Unit Weight - Parameter #1) is reduced by 5 lbs. to account for the reinforcing steel.

3) In some cases, the user may wish to ignore certain strands for moment capacity calculations.

590	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PROPERTIES-PC2	PC2
PURPOSE	This is the second in a series of commands describing the properties of the prestressed, and non-prestressed concrete and the non-prestressed reinforcement. This command is always required for prestressed concrete rating.	

5 COMMAND PARAMETERS

f_Y Girder Default = 60 ksi	Enter the yield stress of the non-prestressed reinforcement in kips/sq. in. This parameter is only required for a composite structure.
f_Y Stirrups Default = 40 ksi	Enter the yield stress of the stirrups in kips/sq. in..
Relative Humidity Default = 60%	If the program will be calculating the time dependent losses, enter the mean annual relative humidity, in percent.
Continuity	Enter 0 or blank for simple span. Enter 1 if the structure is composed of simple spans, made continuous by composite action and non-prestressed reinforcement. Option ‘2' is no longer available. Enter 3 for cast-in-place continuous spans, post-tensioned, with dead load supported by false work.
Loss Method*	Enter the method, which must be entered in capital letters, for calculating the time-dependent prestress losses. INPUT - Losses to be input by user (STRAND-ST2 Command). AASHTO - Losses to be calculated according to AASHTO 9.16.2.1. See Note. PCI - Losses to be calculated according to the PCI General Method. * Not required for the Kansas Prestressed Design module.

EXAMPLE

PC2 60, 40, 60, 1, INPUT

For: f_Y = 60 ksi Girder reinforcing steel

f_Y = 40 ksi Stirrups

Mean Annual Relative Humidity = 60%

Structure composed of simple spans made continuous by composite action and non-prestressed reinforcement.

Losses will be input by user.

FIGURES

NOTES

AASHTO method is not valid for composite structures made continuous by additional prestressing.

600	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PROPERTIES-PC3	PC3
PURPOSE	This is the third in a series of commands describing the properties of prestressed and non-prestressed concrete and non-prestressed reinforcements. This command is required when losses are to be calculated by the PCI General Method.	

6 COMMAND PARAMETERS	
UCR	Enter the ultimate loss of prestress due to creep of concrete, ksi per ksi of compressive stress in the concrete.
Maturity Coefficient Default = 1.00	To account for the effects of creep due to the age of the concrete and the length of moist cure, enter the factor, which may be taken from the Table (See Notes) or from appropriate research data.
USH	Enter the ultimate loss of prestress due to shrinkage of concrete, ksi.
t_S	Enter the time, in days, between the end of curing and the initial prestressing.
t_{CONT}	Enter the time, in days, from the initial prestressing until the structure is made continuous.
t_{COMP}	Enter the time, in days, from the initial prestressing until the structure is made composite.

EXAMPLE

PC3 13.51, , 14.777, 1, 20, 30
The blank will default to 1.

UCR = 13.51

USH = 14.777

1 day from end of curing until initial prestressing.
20 days from initial prestressing until continuity.
30 days from initial prestressing until composite.

FIGURES

NOTES

Creep factors for various ages or prestress and periods of cure.

Age of prestress transfer, days	Period of cure, days	Creep factor, MCF
3	3	1.14
5	5	1.07
7	7	1.00
10	7	0.96
20	7	0.84
30	7	0.72
40	7	0.60

Ref. Modern Prestressing Concrete, Second Edition, by James R. Libby, Van Nostrand Reinhold, 1977, Page 553.

610	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PROPERTIES-PC4	PC4
PURPOSE	This is the fourth in a series of commands describing the properties of prestressed and non-prestressed concrete and non-prestressed reinforcement. This command is required when losses are to be calculated by the PCI General Method.	

6 COMMAND PARAMETERS	
Service Life Default = 50 years	Enter the service life of the structure, in years.
Time of analysis Default = Service Life	Enter the time, in years, from the initial prestressing until the analysis is desired. For most applications, the analysis time is the service life.
t_1	Enter the time of application, in days, measured from initial prestressing, of Stage 1 superimposed dead load applied to all top spans, DLD command.
t_2	Enter the time of application in days, measured from initial prestressing, of Stage 2 superimposed dead load applied to all top spans, DLD command.
t_3	Enter the time of application in days, measured from initial prestressing, of Stage 3 superimposed dead load applied to all top spans, DLD command.
ICHAR Default = 1	Enter the loss characteristic code. See note.

EXAMPLE

PC4 40, 5, 20, 30, 50, 1

For:

40 year service life.
Age of structure at analysis = 5 years.
Stage 1 load applied at 20 days.
Stage 2 load applied at 30 days.
Stage 3 load applied at 50 days.

FIGURES

NOTES

The calculation of losses according to the PCI General Method relies on constants which approximate the conditions of the materials used in the structure. BRASS was written using values for the constants which were based on a summary of existing research data and to allow the user to substitute values which more closely approximate the structure being analyzed. This involves a modification of the program by a program analyst (subroutine pcloss.f, variable PATAP). The user would select this alternate set of constants by inputting a loss characteristic code of 2.

620	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PROPERTIES-PC5	PC5
PURPOSE	This is the fifth in a series of commands describing the properties of prestressed and non-prestressed concrete and non-prestressed reinforcement. This command may be used if the losses are to be calculated by the PCI General Method and additional time intervals are desired.	

6 COMMAND PARAMETERS	
Additional time #1	Enter additional time #1, in days.
Additional time #2	Enter additional time #2, in days.
Additional time #3	Enter additional time #3, in days.
Additional time #4	Enter additional time #4, in days.
Additional time #5	Enter additional time #5, in days
Additional time #6	Enter additional time #6, in days.

EXAMPLE

PC5 2, 90

Losses to be calculated at 2 and 90 days in addition to the times chosen by the program based on input.

FIGURES

NOTES

625	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PROPERTIES -PC6	PC6
PURPOSE	This command describes the properties of prestressed concrete for the Kansas Prestressed Design module.	
4 COMMAND PARAMETERS		
Ultimate Shrinkage Default = 0.600 x 10E - 3 in./in.	Enter the ultimate shrinkage loss.	
Age at release Default = 18 hours	Enter the age (in hours) at release of the pretensioning.	
$E_{release}$ Default = $w^{1.5}33(f'_{ci})^{.5}$	Enter the modulus of elasticity of the prestressed girder at the age of release.	
Creep factor Default = Results obtained using PCA method.	Enter a dimensionless ratio for the creep factor for deflection. This factor is multiplied with the beam deflection at release to obtain creep deflection. For a zero creep deflection, enter 0.0001.	

EXAMPLE

PROPERTIES-PC6 , 24

Ultimate shrinkage loss defaults to 0.600 x 10^{-3} in./in.

Pretensioning released at 24 hr.

E at release defaults to $w^{1.5}33(f'_{ci})^{.5}$

FIGURES

NOTES

630	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	STRAND-ST1	ST1
PURPOSE	This series of commands (STRAND-ST1 through STRAND-ST4 and POST-TENSION1 through POST-TENSION2) of which this is the first, describes the properties of the prestressing strands. Up to 3 sets of strand properties may be defined.	

6 COMMAND PARAMETERS	
Strand Code	Enter the unique strand properties code to be defined by the following parameters on this command, STRAND-ST2 through STRAND-ST3 and POST-TENSION1 through POST-TENSION2. Codes must be sequential. Three codes are allowed.
Strand Type Default = 1	Enter 1 if the strand is a stress-relieved strand. Enter 2 if the strand is a low-relaxation strand.
Method Default = 1	Enter 1 if the strand is pretensioned. Enter 2 if the strand is post-tensioned.
f^*_Y Default = 0.85 f'_S for stress relieved Default = 0.9 f'_S for low relaxation	Enter the yield point stress of the strand in kips/sq. in.
f'_S	Enter the ultimate strength of the strand in kips/sq. in.
E_S Default = 28000	Enter the modulus of elasticity of the strand in kips/sq. in.

EXAMPLE

STRAND-ST1 1, 1, 1, 260, 270, 28000

For:

Strand #1.
Stress-Relieved Strand.
Pretensioned Strand.
260000 yield point stress.
270000 ultimate strength.
28000 modulus of elasticity.

FIGURES

NOTES

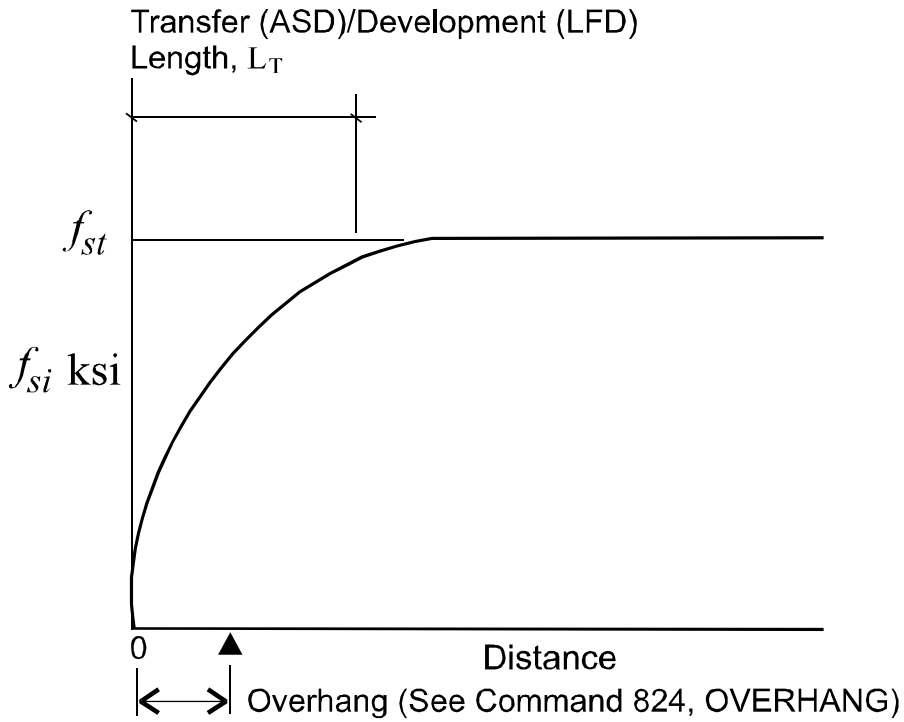
640	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	STRAND-ST2	ST2
PURPOSE	This is the second in a series of commands describing the properties of the prestressing strands. This command would be used when the default values are not applicable or the losses are input by the user.	
7 COMMAND PARAMETERS		
Default = .7 for Stress Relieved Strands Default = .75 for Low Relaxation Strand	Enter the ratio of the initial stress in the strand to the ultimate strength of the strand.	
Δ f final	NOTE: The next 3 parameters are used for an unbonded cable, and are optional for a bonded cable. Anchorage losses should be entered on Command #680, POST-TENSION2. When command PROPERTIES-PC2, Parameter #5 is coded INPUT, enter the final loss in the prestressing strands, excluding friction, in kips per square inch. See Note 1.	
Δ f composite	When command PROPERTIES-PC2, Parameter #5 is coded INPUT, enter the loss of stress in the prestressing strand, excluding friction, between the time the strand is stressed and the time the structure is made composite, in kips per square inch. See Note 1.	
Δ f continuous	For a structure which is simple span for dead load and made continuous for live load, when command PROPERTIES-PC2, Parameter #5 is coded INPUT, enter the loss of stress in the prestressing strand, excluding friction between the time the strand is stressed and the time the structure is made continuous, in kips per square inch. See Note 1.	
Anchorage	For a pretensioned strand, leave blank for a bonded strand, otherwise enter 1 for a strand that is anchored at the girder end. See Note 2.	
L_T	For a pretensioned strand, enter the transfer or development length, from the beam end, in feet. See Figure and Note 3.	
Reduction Factor for Initial Tendon Stress Default = 0.63 for Stress Relieved Strands Default = 0.69 for Low Relaxation Strands	Enter the reduction factor for initial tendon stress according to AASHTO 9.16.2.1.2.	

EXAMPLE

ST2 .7, 45, 35, 30, , 2.5

FIGURES



NOTES

1. For post-tensioned girders, BRASS automatically calculates the friction losses.

2. Setting the anchorage flag for pretensioned strands to 1 would be a very rare occurrence and has the following effect: The transfer/development length is ignored for this strand code. The length or application of debond is not logical in this case and should **not** be input using the DEBOND command. All post-tensioned girder strands are assumed anchored by BRASS. Therefore, this parameter only applies for those rare occasions when pretensioned strands are anchored.

3. Transfer length (Allowable Stress Design) describes the distance needed for the strand to be imbedded into the concrete to be able to carry the service load tensile force on the strand. See Figure above. Development length (Ultimate Strength Design - LFD) describes the distance needed for the strand to be embedded in the concrete to be able to develop the ultimate strength of the strand.

In summary, the STRAND-ST2 parameter for L_T, gives BRASS the distance through which the strand develops full load or strength, the DEBOND command tells BRASS how far from the end of the girder the transfer length begins (per row of strand).

650	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	STRAND-ST3	ST3
PURPOSE	This is the third in a series of commands describing the properties of the prestressing strands. This command would be used when the losses are to be calculated according to AASHTO 9.16.2.1.4 and the default values are not applicable.	

4 COMMAND PARAMETERS

A1 *Default = 20000 for stress-relieved strand, 5000 for low-relaxation strand	Enter the relaxation coefficient, A1. See notes.
A2 *Default for pretensioned members = 0.0, for post-tensioned members, defaults are 0.3 for stress-relieved strand, and 0.07 for low-relaxation strand	Enter the relaxation coefficient, A2. See notes.
A3 *Defaults for post-tensioned members are 0.4 for stress-relieved strand, 0.1 for low-relaxation strand	Enter the relaxation coefficient, A3. See notes.
A4 *Defaults for post-tensioned members are 0.2 for stress-relieved strand, 0.05 for low-relaxation strand	Enter the relaxation coefficient, A4. See notes.

EXAMPLE

ST3 20000, .3, .4, .2

FIGURES

NOTES

References AASHTO 9.16.2.1.4 Pre-tensioned members

CR_S = A1 - A2FR - A3ES - A4(SH + CR_C) (Eqns. 9-10 and 9-10A)

References AASHTO 9.16.2.1.4 (9-11) Post-tensioned members

CR_S = A1 - A2FR - A3ES - A4(SH + CR_C) (Eqns. 9-11, 9-11A and 9-12)

660	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	STRAND-ST4	ST4
PURPOSE	This is the fourth in a series of commands describing the properties of the prestressing strands. This command is required when losses are to be calculated according to the PCI General Method.	

4 COMMAND PARAMETERS

COEF1 Default = 10 for stress-relieved strand, 45 for low-relaxation strand	Enter the relaxation coefficient #1. See notes.
COEF2 Default = .55	Enter the relaxation coefficient #2. See notes.
COEF3 Default = .05	Enter the relaxation coefficient #3. See notes.
ts	For a pretensioned strand, enter the time, in days, between the stressing of the strand and the transfer of stress from this strand to the concrete.

EXAMPLE

ST4 10, .55, .05, 3

FIGURES

NOTES

Ref. Modern Prestressed Concrete, Second Edition by James R. Libby, VanNorstrand Reinhold, 1977, Page 554.

The loss due to relaxation, RET, may be calculated by the following equation:

$$RET = f_{st} ((\log 24_t - \log 24_{t_1}) / COEF1) * (f_{st} / f_{py} - COEF2)$$

where $f_{st} / f_{py} - COEF2 \geq COEF3$

$f_{py} = 0.85 f_{pu}$

665	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	STRAND-ST5	ST5
PURPOSE	This command describes the properties of prestressing steel for design. This command is required for the Kansas Prestressed Design module, not prestressed concrete rating.	

6 COMMAND PARAMETERS

Area P^*_S Strand Default = 0.153 sq. in.	Enter the area of one prestressing strand, in square inches.
f'_S	Enter the ultimate strength of the prestressing strand, in kips per square inch.
f^*_Y Default = 0.90 f'_S for low-relaxation strands or 0.85 f'_S for stress-relieved strands.	Enter the yield point stress of the prestressing strand, in kips per square inch.
Jacking stress Default = 0.75 f'_S for low-relaxation, 0.70 f'_S for stress-relieved and 'OTHER'	Enter the Jacking Stress, in kips per square inch.
E P^*_S steel Default = 28,000 ksi	Enter the modulus of elasticity of the prestressing strand, in kips per square inch.
Strand Type	Enter LOW for low relaxation strands. Enter STR for stress-relieved strands. Enter OTH for other strand types.

EXAMPLE

STRAND-ST5 , 270, , , , LOW

Area of one prestressing strand defaults to 0.153 sq. in.

f'_s = 270 ksi.

f^*_Y defaults to 243.0 ksi (270 X 0.9).

Jacking stress defaults to 202.5 ksi (270 X 0.75)

E of the prestressing steel defaults to 28,000 ksi.

Low relaxation strands.

FIGURES

NOTES

670	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	POST-TENSION1	PT1
PURPOSE	This is the fifth in a series of commands describing the properties of prestressing strands. This command is required for post-tensioned strands.	

5 COMMAND PARAMETERS

Bonding	Enter 1 if the strand is unbonded throughout its entire length.
K	Enter the friction wobble coefficient for the strand, in k/ft.
μ	Enter the friction curvature coefficient for the strand.
Elastic Shortening Default = 0.5	Enter the factor for loss of prestress due to elastic shortening of member. For normal prestressing operations the factor will be .5.
Tension End Default = 0	Enter 0, or leave blank, if the strand is tensioned from the left end of the span. Enter 1, if the strand is tensioned from the right end of the span. Enter 2, if the strand is tensioned from both ends.

EXAMPLE

```
POST-TENSION1        1,      .0020,      .30,    .5,      2
```

FIGURES

NOTES

680	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	POST-TENSION2	PT2
PURPOSE	This is the sixth and last in a series of commands describing the properties of prestressing strands. This command is used to account for the loss of prestress due to anchorage set.	

2 COMMAND PARAMETERS

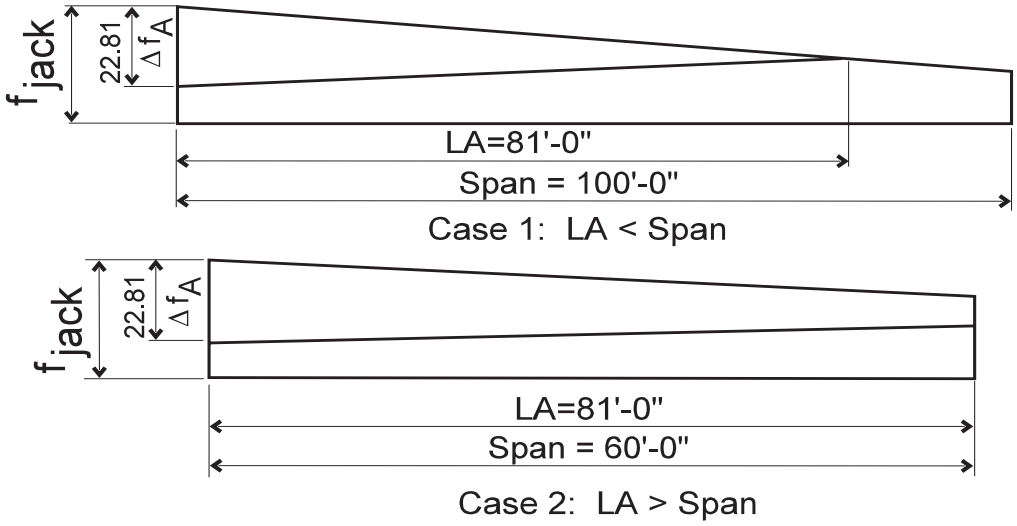
$\triangle f_A$	Enter the anchorage loss at the stressing end, in kips/sq.in.
LA	Enter the distance from the stressing end to the point where the anchorage loss is zero, in feet.

EXAMPLE

Refer to Figure

PT2 22.81, 81

FIGURES



NOTES

12. PRESTRESSING STRAND

The following commands are used to describe the location of prestressing strands in the girder.

CABLE LAYOUT COMMANDS

The input of the cable layouts requires one or more of the following four series of commands:

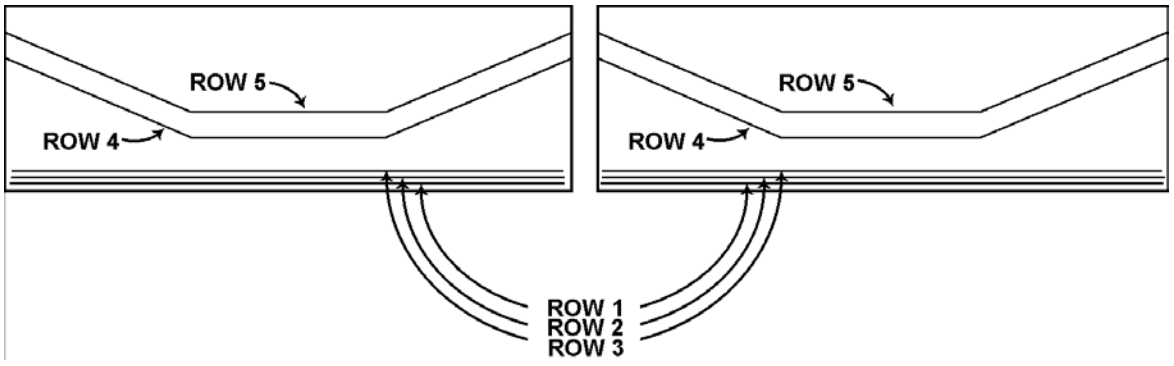
CABLE - S1 and CABLE - S2	- for straight pretensioned strands
CABLE - H1 through CABLE - H3	- for harped pretensioned strands
CABLE - P1 and CABLE - P2	- for parabolic draped post tensioned strands
CABLE - PC1 through CABLE - PC3	- for reversed parabolic post tensioned strands in continuous spans

and the command:

CABLE - DUP - which duplicates spans with identical layouts.

These commands may be combined in any sequence to define up to 20 rows per span. The row number for each span must be numbered consecutively.

Example:



NOTE: BRASS does not have the capability of analyzing a combination of pretensioned and post tensioned strands in a single girder.

690	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CABLE-S1	CS1
PURPOSE	This set of commands, CABLE-S1 and CABLE-S2, defines the properties and geometry of straight strands. Note: This command may be used for a precast, prestressed concrete girder rating only.	

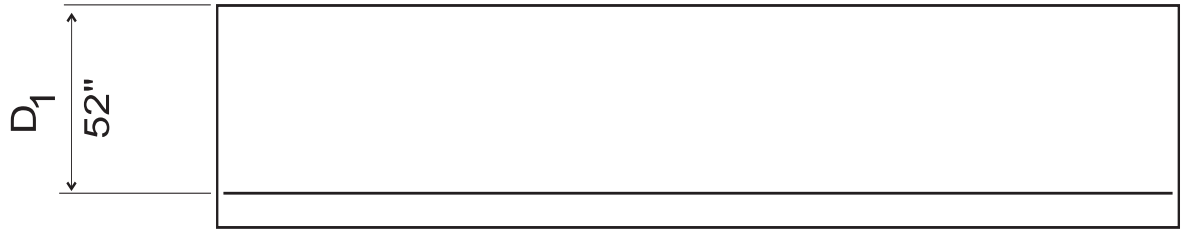
5 COMMAND PARAMETERS	
SPAN	Enter the number of the span for which the layout is being described.
ROW	Enter the number of the row being described. The rows must be numbered consecutively bottom to top.
Number of Strands	Enter the number of strands in this row.
Area	Enter the area of each strand, in sq. in.
D1	Enter the distance from the top of the girder to the centroid of this row, in inches.

EXAMPLE

For the layout shown below which is Row 1 for Span 2, containing 5 strands with an area of .153 sq. in. per strand, the CABLE-S1 command would be coded as:

```
CABLE - S1        2,        1,        5,        .153,        52
CABLE - S2
```

FIGURES



NOTES

700	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CABLE-S2	CS2
PURPOSE	This command defines the properties of the strand and rows which are identical to the initial row. This command is not required if the values for the first two parameters equal the default values and there are no additional identical rows. Note: This command may be used for a precast, prestressed concrete girder rating only.	

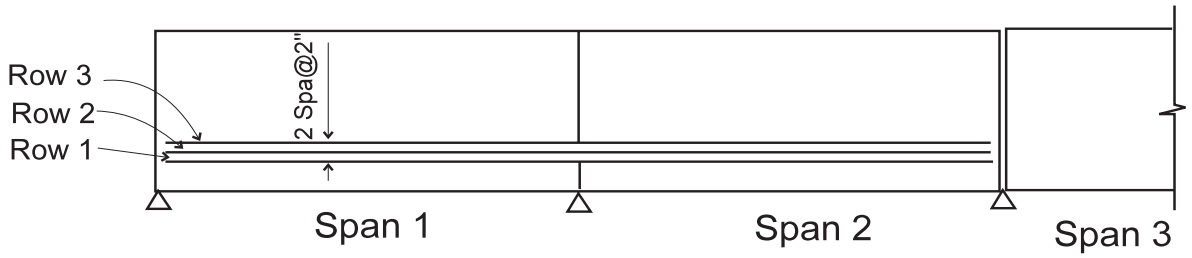
5 COMMAND PARAMETERS	
Stage Default = 1	Enter the stage of construction in which this row of strands is tensioned.
Strand Code Default = 1	Enter the strand properties code representing the properties of the strands in this row. This code must correspond to a strand code defined by STRAND-ST1 through ST4 commands.
Continuity Default = 0	This parameter applies to post-tensioned girders only. For interior spans: Leave blank, or enter 0 if this row is not continuous over either support. Enter 1 if this row of strands is continuous over the left support. Enter 2 if this row of strands is continuous over the right support. Enter 3 if this row of strands is continuous over both supports.
Identical Rows	If more than one row of strands are identical (number of strands, area of each strand, strand type; and are equally spaced) enter the number of additional rows.
D2	For identical rows, enter the vertical spacing in inches between each row.

EXAMPLE

For the layout shown below, Span 2, with the strands stressed in Stage 2 and Strand type 2, the CABLE-S2 command would be coded as:

CS2 2, 2, 1, 2, 2

FIGURES



Row 1 described and Rows 2 & 3 given the same properties but different strand location.

NOTES

710	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CABLE-H1	CH1
PURPOSE	This set of commands, CABLE-H1 through CABLE-H3, defines the properties and geometry of harped strands. Note: This command may be used for a precast, prestressed concrete girder rating only.	

6 COMMAND PARAMETERS	
Span	Enter the number of the span for which the layout is being described.
Row	Enter the number of the row being described. The rows must be numbered consecutively bottom to top.
Number of Strands	Enter the number of strands in this row.
Area	Enter the area strand, in sq. in.
D_1	Enter the distance from the top of the girder to the centroid of the row of strands at the left end, in inches.
D_2	Enter the distance from the top of the girder to the centroid of the row of strands at the harp points, in inches.

EXAMPLE

For the example structure shown below in Figure 1, with

SPAN No. = 1
ROW No. = 1
No. Strands = 5
AREA OF EACH STRAND = .153 sq. in.

CABLE-H1 command would be coded as:

```
CABLE-H1 1,      1,      5,      .153,   48          72
CABLE-H2
CABLE-H3
```

FIGURES

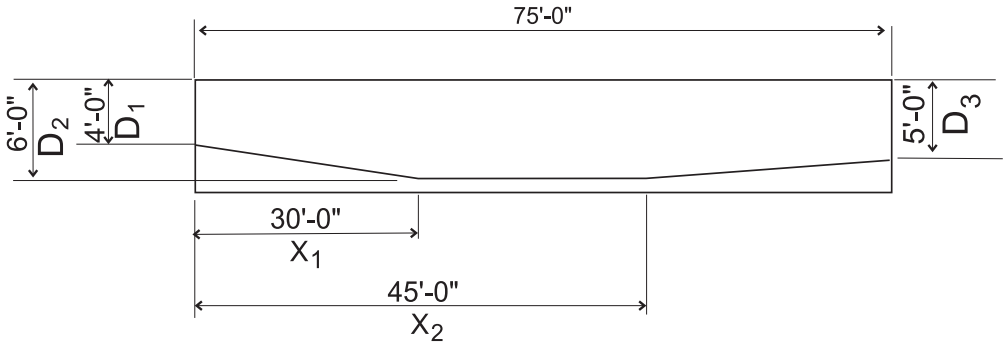


Figure 1 - Harped Strands

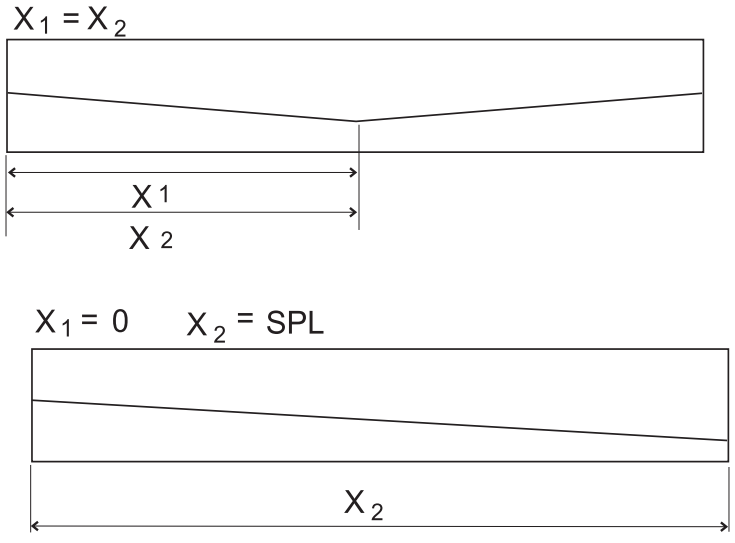


Figure 2 - Special Cases

720	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CABLE-H2	CH2
PURPOSE	This is the second in a series of commands defining the properties and geometry of harped strands. Note: This command may be used for a precast, prestressed concrete girder rating only.	

5 COMMAND PARAMETERS

D_3 Default = D_1	Enter the distance from the top of the girder to the centroid of the row of strands at the right end of the span, in inches.
X_1	Enter the distance from the left end of the span to the first harp point, in feet. See Note.
X_2	Enter the distance from the left end of the span to the second harp point, in feet. See Note.
Stage Default = 1	Enter the Stage of Construction in which this strand is tensioned.
Strand Code Default = 1	Enter the strand properties code representing the properties of the strands in this row. This code must correspond to a strand code defined by STRAND-ST1 through STRAND-ST4 commands.

EXAMPLE

For the example structure shown below in Figure 1, with strands stressed in stage 1, strand type 1, the CABLE-H2 command would be coded as:

```
CABLE-H1
CABLE-H2 72,     30,     45,     1,      1
CABLE-H3
```

FIGURES

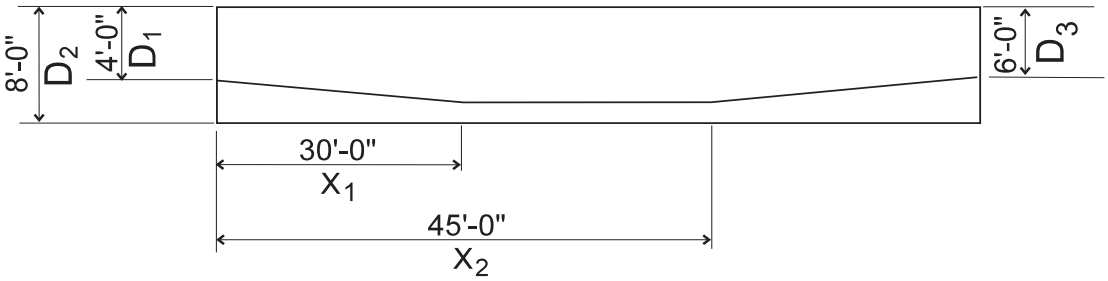


Figure 1 - Harped Strands

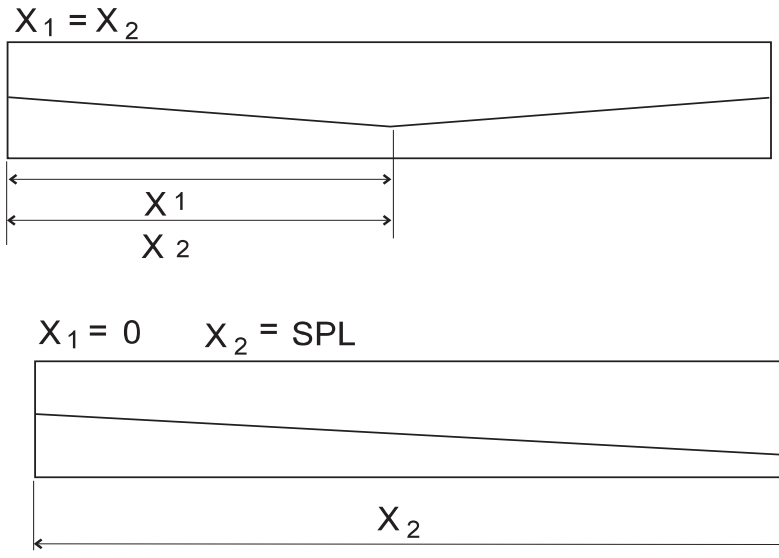


Figure 2 - Special Cases

NOTES

For accurate calculation of the vertical component of the strand force, node points must be located at the harp points. See TRANSFER command, page 12.30.

730	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CABLE-H3	CH3
PURPOSE	This is the third in a series of commands defining the properties and geometry of strands identical to the row of strands first described. This command is required only if there are additional identical rows above the one described on the CH1 and CH2 commands. Note: This command may be used for a precast, prestressed concrete girder rating only.	

3 COMMAND PARAMETERS	
Identical Rows	If more than one row of strands are identical (number of strands, area of each strand, strand type; and equally spaced) enter the number of additional rows.
D_4	For identical rows, enter the vertical spacing between each row, at the ends of the span, in inches.
D_5 Default = D_4	For identical rows, enter the vertical spacing between each row, at the harp points, in inches.

EXAMPLE

For 4 additional rows spaced at 6" at the ends of the span and 2" at the center of the span, the CABLE-H3 command would be coded as:

```
CABLE-H1
CABLE-H2
CABLE-H3          4,          6,          2
```

FIGURES

NOTES

740	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CABLE-P1	CP1
PURPOSE	This set of commands CABLE-P1 and CABLE-P2, defines the properties and geometry of parabolic strands. Note: This command may be used for a precast, prestressed concrete girder rating only.	

6 COMMAND PARAMETERS	
SPAN	Enter the number of the span for which the layout is being described.
ROW	Enter the number of the row being described. The rows must be numbered consecutively bottom to top.
Number of Strands	Enter the number of strands in this row.
Area	Enter the area of each strand in square inches.
D_1	Enter the distance from the top of the girder to the centroid of the row of strands at the left end of the span, in inches.
D_2	Enter the distance from the top of the girder to the centroid of the row of strands at the low point of the drape, in inches.

EXAMPLE

For the example shown below in Figure 1, which is Row 1 for Span 2, containing 20 strands with an area of .153 sq. In. per strand, the CABLE-P1 command would be coded as:

```
CABLE-P1        2,        1,        20,       .153,     24,       72
CABLE-P2
```

FIGURES

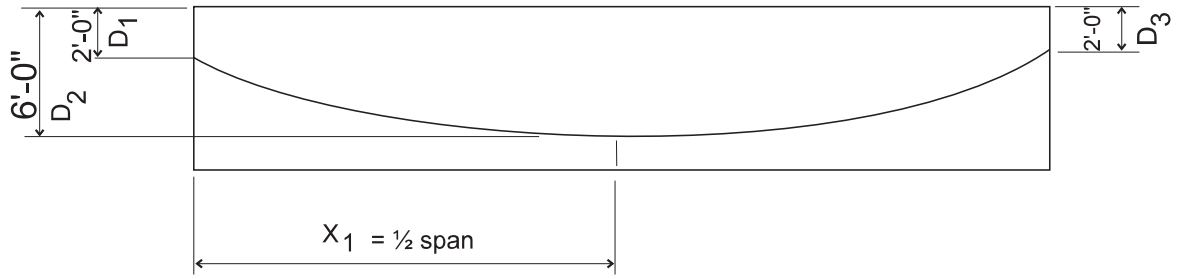


Figure 1 - Parabolic Draped Strands

NOTES

750	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CABLE-P2	CP2
PURPOSE	This is the second command defining the properties and geometry of parabolic draped strands. This command is required when the parameter values are not the same as the default values. Note: This command may be used for a precast, prestressed concrete girder rating only.	

6 COMMAND PARAMETERS	
X_1 Default = $^1/_2$ span length	Enter the distance from the left end of the girder to the low point of the drape, in feet.
D_3 Default = D_1	Enter the distance from the top of the girder to the centroid of the row of strands at the right end of the span, in inches.
Stage Default = 1	Enter the Stage of construction in which this strand is tensioned.
Strand Code Default = 1	Enter the strand properties code representing the properties of the strands in this row. This code must correspond to a strand code defined by STRAND-ST1 through STRAND-ST4 commands.
Identical Rows	If more than one row of strands are identical (number of strands, area of each strand, and strand type; and are equally spaced), then enter the number of additional rows.
D_4	For identical rows, enter the spacing in inches, between each row.

EXAMPLE

For the example shown below in Figure 1, the strands are stressed in STAGE 1, are STRAND TYPE 1, and there are an additional 3 rows at 4" spacing. The CABLE-P2 command would be coded as:

CABLE-P1
CABLE-P2 , , , , 3, 4

The first blank will default to 1/2 span length, the second blank will default to 24, the third blank will default to 1 and the fourth blank will default to 1.

FIGURES

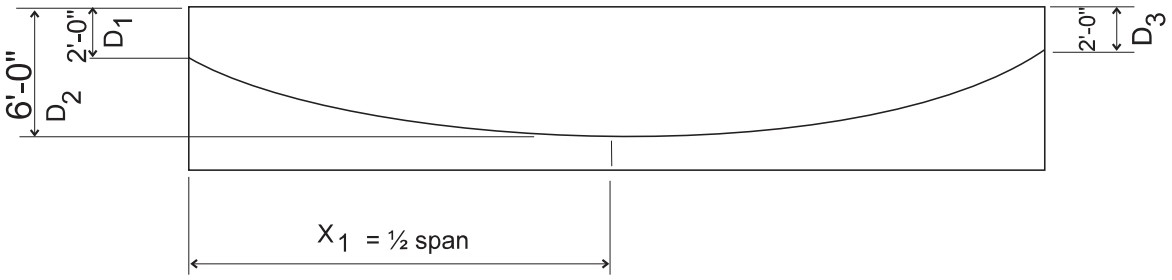


Figure 1 - Parabolic Draped Strands

NOTES

760	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CABLE-PC1	CB1
PURPOSE	This set of commands, CABLE-PC1 through CABLE-PC3, defines the properties and geometry of parabolic draped strands reversed for continuity. This command must be followed by the CABLE-PC2 and CABLE-PC3 commands. See Notes. Note: This command may be used for a precast, prestressed concrete girder rating only.	

6 COMMAND PARAMETERS	
SPAN	Enter the number of the span for which the layout is being described.
ROW	Enter the number of the row being described. The rows must be numbered consecutively.
Number of Strands	Enter the number of strands in this row.
Area	Enter the area of each strand in sq. in.
D_1	Enter the distance from the top of the girder to the centroid of the row of strands, at the left end of the span, in inches.
D_2	Enter the distance from the top of the girder to the centroid of the row of strands, at the left inflection point, in inches.

EXAMPLE

For the example shown below in Figure 1, which is row 10 for span 2, containing 20 strands with an area of .153 sq. in. per strand, the CABLE-PC1 command would be coded as:

CABLE-PC1 2, 10, 20, .153, 60, 84
CABLE-PC2
CABLE-PC3

FIGURES

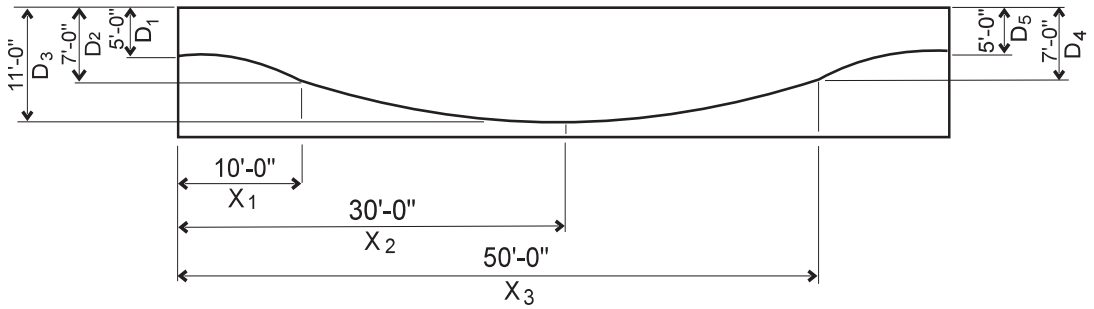


Figure 1-Parabolic Draped Strand
Reversed for Continuity

$D_2 = D_1$

$X_1 = 0$

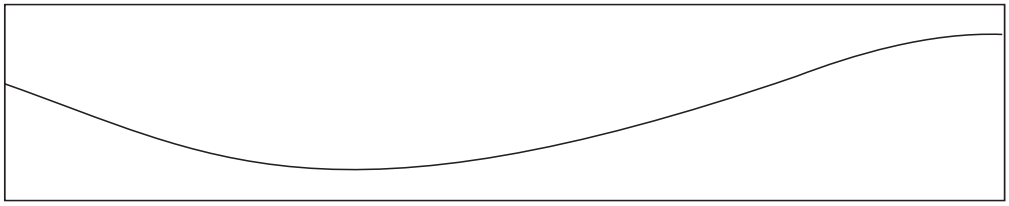


Figure 2 - Special Case
(Used when there is no continuity over left support.
May be reversed by setting X_3 to span length and $D_4 = D_5$ for no continuity over right support.)

NOTES

For the slope to be the same on each side of the inflection point, the ratio of $(D_2-D_1)/X_1$ must equal the ratio of $(D_3-D_2)/(X_2-X_1)$ and the ratio of $(D_5-D_4)/(\text{SPAN LENGTH}-X_3)$ must equal the ratio of $(D_3-D_4)/(X_3-X_2)$. If these ratios are not equivalent, an error message will be placed in the output file and BRASS-GIRDER™ will terminate.

770	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CABLE-PC2	CB2
PURPOSE	This is the second command defining the geometry of parabolic draped strands, reversed for continuity. This command must be followed by the CABLE-PC3 command. See Notes. Note: This command may be used for a precast, prestressed concrete girder rating only.	

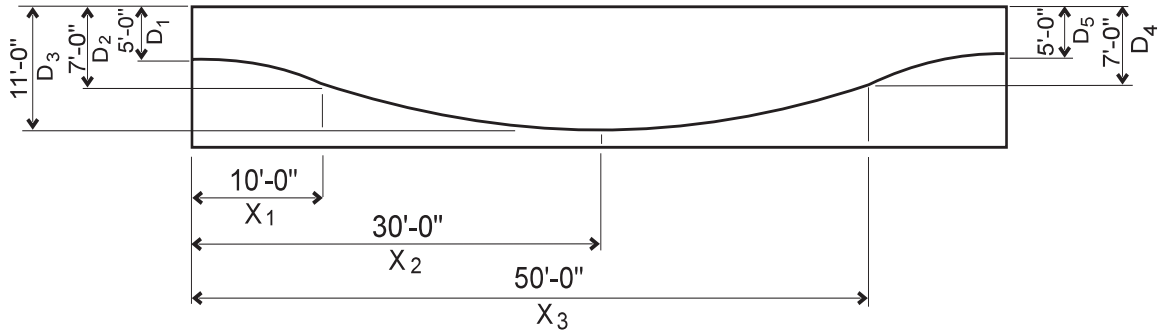
6 COMMAND PARAMETERS	
X_1	Enter the distance from the left end of the span to the left inflection point, in feet.
D_3	Enter the distance from the top of the girder to the centroid of the row of strands at the low point of the drape, in inches.
X_2 Default = $^1/_2$ span length	Enter the distance from the left end of the span to the low point of the drape, in feet.
D_4 Default = D_2	Enter the distance from the top of the girder to the centroid of the row of strands at the right inflection point, in inches.
X_3 Default = (Span Length - X_1)	Enter the distance from the left end of the span to the right inflection point, in feet.
D_5 Default = D_1	Enter the distance from the top of the girder to the centroid of the row of strands at the right end of the span, in inches.

EXAMPLE

For the example shown below, the CABLE-PC2 command would be coded as:

CABLE-PC1
CABLE-PC2 10, 132, 30, 84, 50, 60
CABLE-PC3

FIGURES



NOTES

For the slope to be the same on each side of the inflection point, the ratio of $(D_2-D_1)/X_1$ must equal the ratio of $(D_3-D_2)/(X_2-X_1)$ and the ratio of $(D_4-D_5)/(\text{SPAN LENGTH}-X_3)$ must equal the ratio of $(D_3-D_4)/(X_3-X_2)$. If these ratios are not equivalent, an error message will be placed in the output file and BRASS-GIRDER™ will terminate.

780	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CABLE-PC3	CB3
PURPOSE	This is the third command defining the properties of parabolic draped strands, reversed for continuity and to duplicate additional identical evenly spaced rows. See Notes. Note: This command may be used for a precast, prestressed concrete girder rating only.	

5 COMMAND PARAMETERS	
Stage Default = 1	Enter the Stage of construction in which this strand is tensioned.
Strand Code Default = 1	Enter the strand properties code representing the properties of the strands in this row. This code must correspond to a strand code defined by STRAND-ST1 through STRAND-ST4 commands.
Identical Rows	If more than one row of strands are identical (number of strands, area of each strand and strand type; and equal spacing) enter the number of additional rows.
D_6	For identical rows, enter the spacing in inches between each row.
Continuity	Leave blank, or enter 0, if this row is continuous over both supports. Enter 1 if this row is coupled (anchored) over the left support and continuous over the right support. Enter 2 if this row is coupled (anchored) over the right support and continuous over the left support. Enter 3 if this row is coupled (anchored) over both supports.

EXAMPLE

CABLE-PC1
CABLE-PC2
CABLE-PC3 2, 1, 3, 24

Describe a row of Type 1 strands stressed in STAGE 2. There are 3 additional identical rows with a spacing of 24 inches.

FIGURES

NOTES

For the slope to be the same on each side of the inflection point, the ratio of $(D_2-D_1)/X_1$ must equal the ratio of $(D_3-D_2)/(X_2-X_1)$ and the ratio of $(D_4-D_5)/(\text{SPAN LENGTH}-X_3)$ must equal the ratio of $(D_3-D_4)/(X_3-X_2)$. If these ratios are not equivalent, an error message will be placed in the output file and BRASS-GIRDER™ will terminate.

810	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CABLE-DUP	DUP
PURPOSE	This command defines duplicate spans which have identical strand layouts. This command may be used a maximum of 4 times. Note: This command may be used for a precast, prestressed concrete girder rating only.	

6 COMMAND PARAMETERS	
Span	Enter the span for which the cable layout has been described.
First Identical	Enter the first identical span. If all spans are identical, code ALL.
Second Identical	Enter the second identical span.
Third Identical	Enter the third identical span.
Fourth Identical	Enter the fourth identical span.
Fifth Identical	Enter the fifth identical span.

EXAMPLE

For a 5 span structure with spans 2, 3, and 4 having identical cable layouts, the CABLE-DUP command would be coded as:

```
CABLE-DUP       2,      3,      4
```

FIGURES

NOTES

This command does not duplicate DEBOND.

820	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DEBOND	DBD
PURPOSE	This command defines which strands are debonded and the length of the debond for pre-tensioned straight strands only. Note: This command may be used for a precast, prestressed concrete girder rating only.	

6 COMMAND PARAMETERS

SPAN	Enter the span number.
ROW_B	Enter the beginning row number.
ROW_E Default = ROW_B	Enter the ending row number.
Number of Strands	Enter the number of strands in each row to be debonded.
XD_1	Enter the length of debond at the left end of the beam, in feet.
XD_2 Default = XD_1	Enter the length of debond at the right end of the beam, in feet.

EXAMPLE

For the example shown below the DEBOND command would be coded as:

DEBOND 1, 1, , 3, 4, 4

The blank will default to 1.

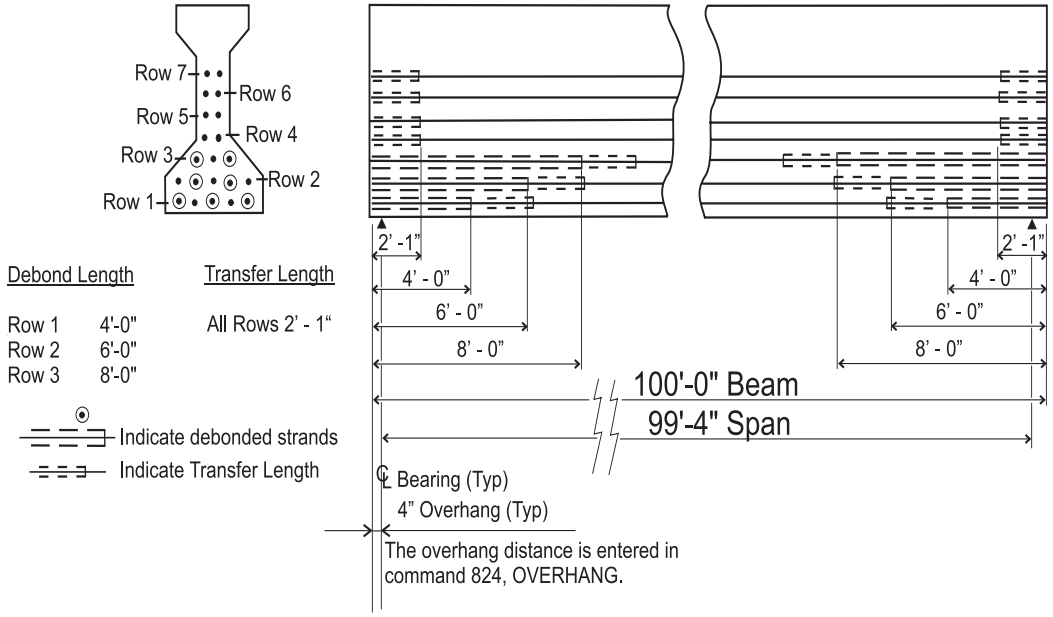
DEBOND 1, 2, , 2, 6, 6

The blank will default to 2.

DEBOND 1, 3, , 2, 8,

The first blank will default to 3 and the second blank will default to 8.

FIGURES



NOTES

1. This command is not valid for a post-tensioned girder.

2. In the BRASS-GIRDER™ output file, the program generates a new row for the debonded strands, unless all the strands in the row are debonded. For example, when the user inputs five strands (2 normal and 3 debonded), in row 1 (as shown in the figure above), the output file will print results for row 1 (2 strands) and row 8 (3 debonded strands).

823	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	TRANSFER	XFR
PURPOSE	This command may be used to define up to 18 additional node points, per span, on a timber, steel, reinforced concrete or prestressed concrete girder such as harp points. This command may not be used for a precast, prestressed concrete girder design or a reinforced concrete girder design.	

19 COMMAND PARAMETERS	
Span No.	Enter the number of the span being described.
First Additional Node Point Location (Feet)	Enter the distance in feet from the left end of the span (not beam) to the first additional node point in the span. See Figure 1
Second Additional Node Point Location (Feet)	Enter the distance in feet from the left end of the span (not beam) to the second additional node point in the span. See Figure 1.
Repeat for up to 18 Additional Node Points	

EXAMPLE

The HINGE command, page 10.42, allows the user to select locations where a node point will be inserted. The TRANSFER command allows you to select up to 18 additional node points along the span.

TRANSFER 1, 1.75, 5.75, 7.75, 9.75, 90.25, 92.25, 94.25, 98.25

FIGURES

NOTES

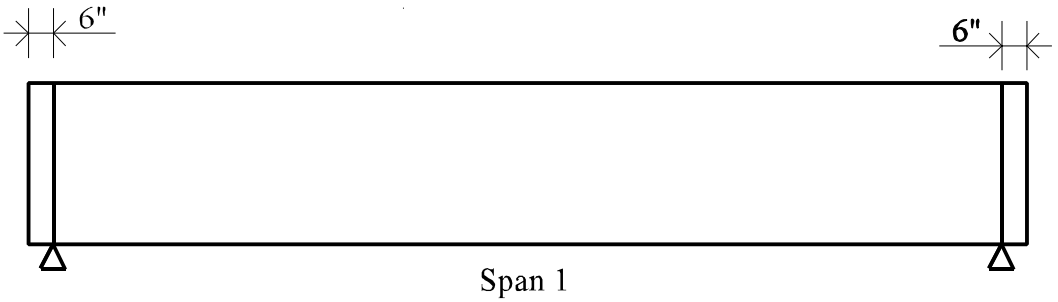
824	BRASS-GIRDER	COMMAND DESCRIPTION	
COMMAND NAME		**PS-BEAM-OVERHANG**	**PBO**
PURPOSE		Used to specify the beam overhang past the centerline of bearing for a prestress beam when pretensioned strands are used. This command is optional. See Note 3.	
3 COMMAND PARAMETERS			
Span Number		Enter the number of the span for which the beam overhangs are being defined.	
Beam Overhang (Left End) Default = 0.0 or if span number > 1, then Default = Beam Overhang (Left End) of Span 1		Enter the beam overhang distance, in inches, past the centerline of bearing at the left end of the span. See Figure 1 and Notes.	
Beam Overhang (Right End) Default = Beam Overhang (Left End) or if span number > 1, then Default = Beam Overhang (Right End) of Span 1		Enter the beam overhang distance, in inches, past the centerline of bearing at the right end of the span. See Figure 1 and Notes.	

EXAMPLE

If the beam overhang past the centerline of bearing at each end of a simple span is 6 inches, code as:

```
PS-BEAM-OVERHANG  1,   6,    6
```

FIGURES



NOTES

1. If debond lengths are specified, the debond lengths are measured from the end of the beam. Transfer and development lengths are measured from the end of the beam. See command 640, STRAND-ST2.

2. The strand profile is not adjusted to account for the beam overhang. The vertical and horizontal distances describing the strand profile reference the end of the span, not the end of the beam.

3. Warning: Do not use unless the transfer/development length + debond is greater than the overhang length.

825	BRASS-GIRDER™	COMMAND DESCRIPTION

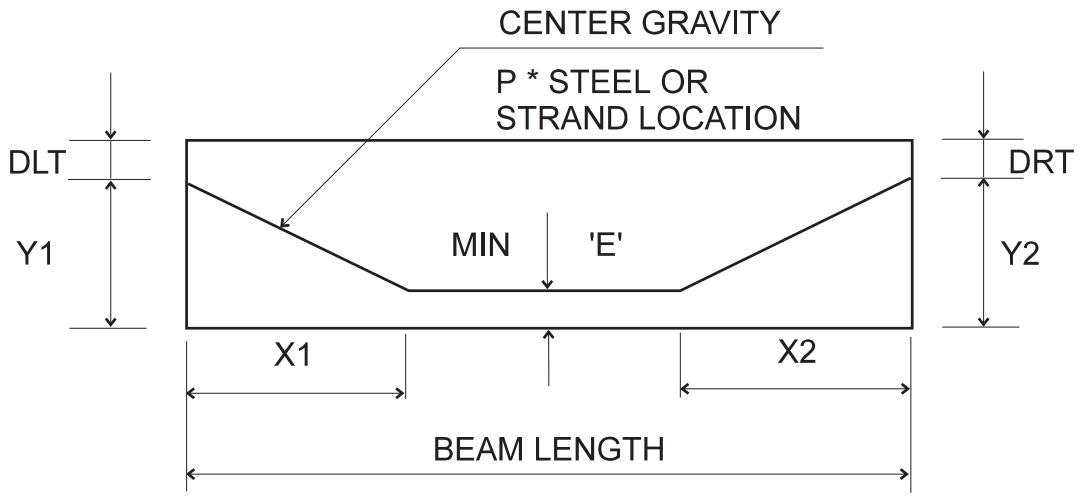
COMMAND NAME	CABLE-DES	CDS
PURPOSE	This command defines the geometry of the prestressing strands for design. This command is required once for each span.	

8 COMMAND PARAMETERS	
Span	Enter the span number.
Number of Strands	If JFORCE (PRESTRESS-3 command, parameter No. 8) is 1 or 2, enter the number of prestressing strands. If JFORCE is 0, leave blank.
Min E	Enter the distance from the bottom of the girder to the centroid of the strand pattern at mid-span, in inches.
Y1	Enter the distance from the bottom of the girder to the centroid of the strand pattern at the left end of the span, in inches.
Y2	Enter the distance from the bottom of the girder to the centroid of the strand pattern at the right end of the span, in inches.
X1	Enter the distance to the first harp point, in feet.
X2	Enter the distance to the second harp point, in feet.
JPARA	Code 0 if this span has harped strands. Code 1 if this span has parabolic strands. Leave X1 and X2 blank. Code -1 if this span has only straight strands. Leave Y1, Y2, X1, and X2 blank.

EXAMPLE

```
CABLE-DES    1,    26,    3.85,    17.38,    17.38,    32,    32,    0
```

FIGURES



NOTES

826	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PS-BEAM-SHEAR	PBS
PURPOSE	This command is used to control the computational method of shear resistance for simple span prestress girders made continuous for live load. This command is optional.	

5 COMMAND PARAMETERS

Near Interior Support Positive Moment Default = 2	Enter one of the following options for computing shear resistance: 1. Vci, Vcw Current AASHTO Specifications 2. 1979 AASHTO Interim Specifications 3. As reinforced concrete, per current AASHTO Specifications
Near Interior Support Negative Moment Default = 3	Enter one of the following options for computing shear resistance: 1. Vci, Vcw Current AASHTO Specifications 2. 1979 AASHTO Interim Specifications 3. As reinforced concrete, per current AASHTO Specifications
Away From Interior Support Positive Moment Default = 1	Enter one of the following options for computing shear resistance: 1. Vci, Vcw Current AASHTO Specifications 2. 1979 AASHTO Interim Specifications 3. As reinforced concrete, per current AASHTO Specifications
Away From Interior Support Negative Moment Default = 1	Enter one of the following options for computing shear resistance: 1. Vci, Vcw Current AASHTO Specifications 2. 1979 AASHTO Interim Specifications 3. As reinforced concrete, per current AASHTO Specifications
Near Support Definition, % Default = 25%	Enter the % of span length to be used to determine “near” support.

EXAMPLE

PS-BEAM-SHEAR 1, 1, 1, 1, 25

FIGURES

NOTES

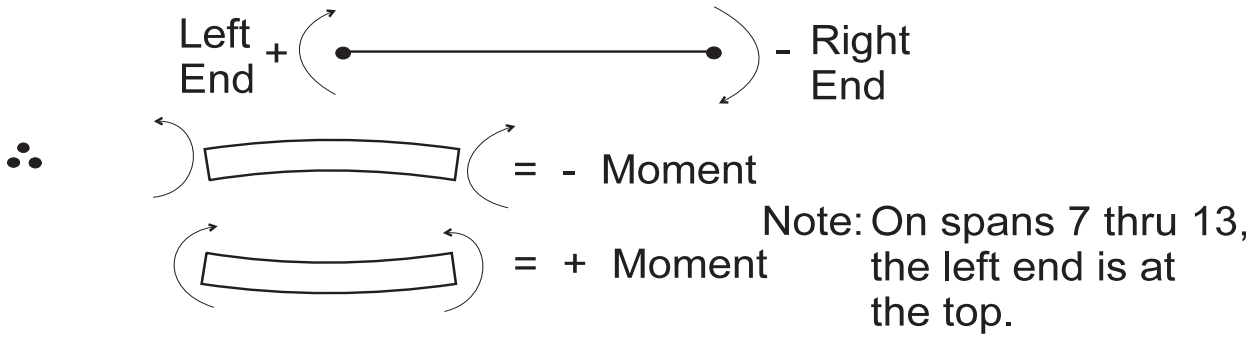
13. STRUCTURE LOADING

The following commands, pages 13.2 through 13.30, are used to describe the dead and live loads to be applied to the structure. The type of loads to be applied will dictate the commands required.

Dead loads may be divided into 4 different groups and each group may be applied in a specified stage of construction. This may be in addition to the weight of the girder and deck.

SIGN CONVENTION

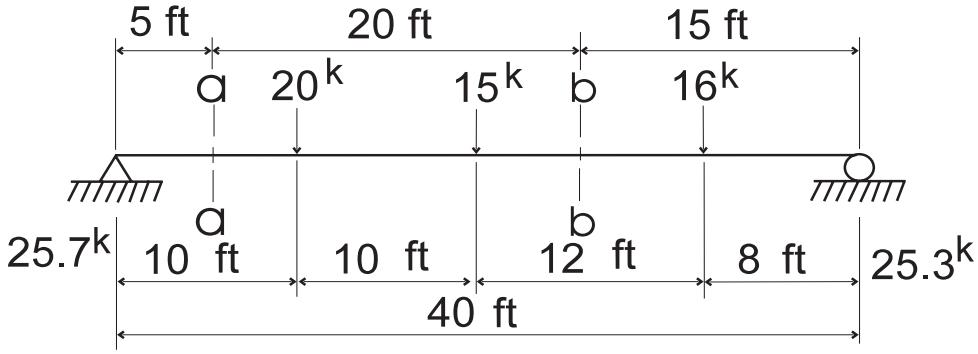
MOMENT



SHEAR

Shear is defined as the algebraic summation of the external forces to the left or to the right of a section that are perpendicular to the axis of the beam. It is considered to be positive if the sum of the forces to the left is up or the sum of the forces to the right is down. The calculations for shear at two sections in a simple beam are given in the example. In each case the summations are made both to the left and to the right to prove that identical results are obtained.

EXAMPLE



SOLUTION

Shear at section a-a:
V_{a-a} to left = 25.7 K ↑ , or +25.7 K
V_{a-a} to right = 20+15+16-25.3 = 25.7 K ↓ , or +25.7 K
Shear at section b-b:
V_{b-b} to left = 25.7-20-15 = 9.3 K ↓ = -9.3 K
V_{b-b} to right = 16-25.3 = 9.3 K ↑ = -9.3 K

AXIAL

Axial actions which cause compression in a member are positive. Axial actions which cause tension in a member are negative.

LIVE LOAD ACTIONS

For live load actions, BRASS creates influence lines with ordinates at 1/denominator times the length of span one. The denominator defaults to 100, but may be controlled by the user by parameter 4 of the LIVE-LOAD command. Truck wheel loads and uniform loads are placed on these influence lines and the sum of the ordinates affected are used to calculate the actions. If a wheel load falls between two ordinates, the program uses the closest ordinate. No interpolation is done. Similarly, a lane load is placed on ordinates of the proper sign, but a small amount may be neglected because of the end triangles (zero to the first ordinate with value). Therefore, the results are approximate, but because of the many points on the influence line, the results are generally very close to the exact answer.

This may become a factor on when span one is less than 50 feet. If so, the denominator can be increased. If the denominator causes the distance between ordinates to be less than 0.1 feet, the program automatically reduces the denominator until the restriction is satisfied.

Further explanation is contained in the description of the fourth parameter of the LIVE-LOAD command.

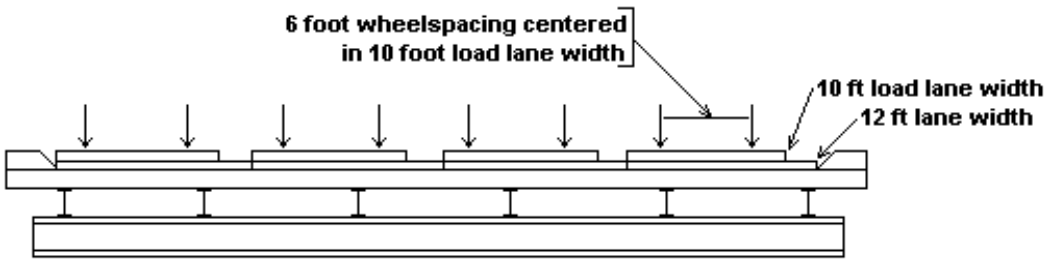
BRASS-GIRDER Rating of Floorbeams

Herein, the longitudinal direction is parallel to the centerline of the roadway and the transverse direction is parallel to the floorbeam.

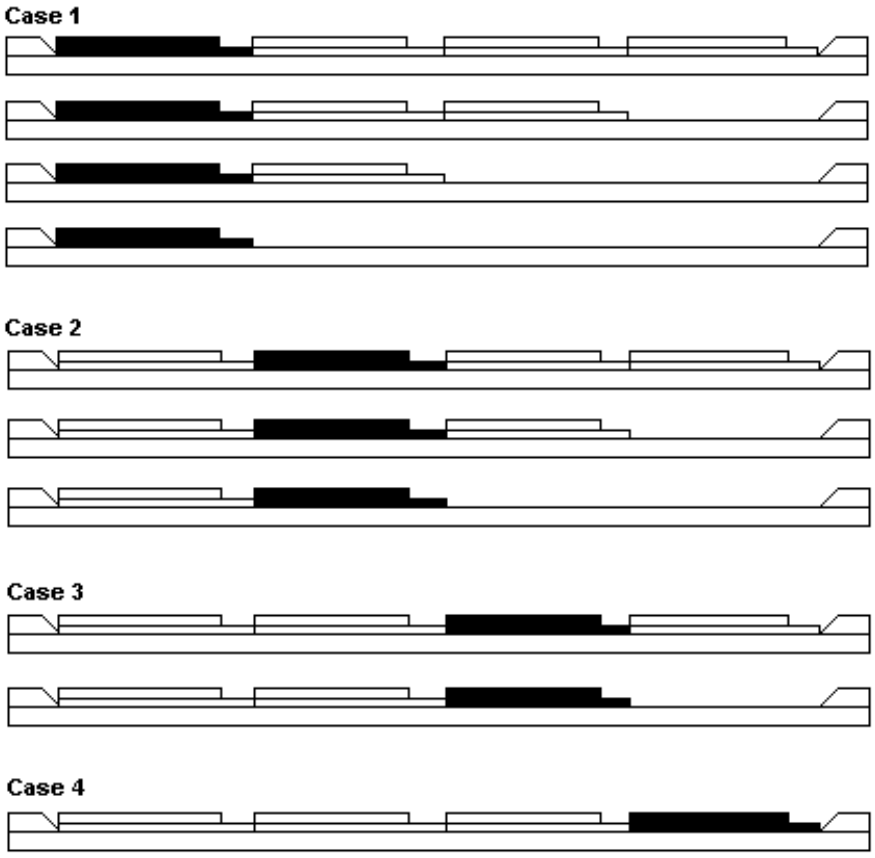
The rating of a steel floorbeam is similar to the rating of a steel longitudinal girder whereby the calculation of girder properties, structural analysis, and determination of strength can be addressed in a similar manner. Dead loads may be passed to BRASS-GIRDER as uniform or point loads; self-weight can be determined by BRASS-GIRDER based on section properties.

The primary difference is in the computation of the live load effects. Live loads to be applied to the floorbeam are truck wheel line reactions (TWLR). In general, the live load to be applied to a floorbeam for a typical truck is two wheel-line reactions spaced six feet apart. TWLR must be determined by the longitudinal analysis of either a stringer, or a deck in the case of stringer-less systems. The computation of the TWLR is performed separately from the floorbeam analysis. A longitudinal analysis/rating program such as BRASS-GIRDER may be used to perform longitudinal analysis to obtain the TWLR. Impact is calculated during the floorbeam analysis based on the length of the floorbeam or as input by the user. Therefore, impact should not be used during the longitudinal analysis to determine the TWLRs.

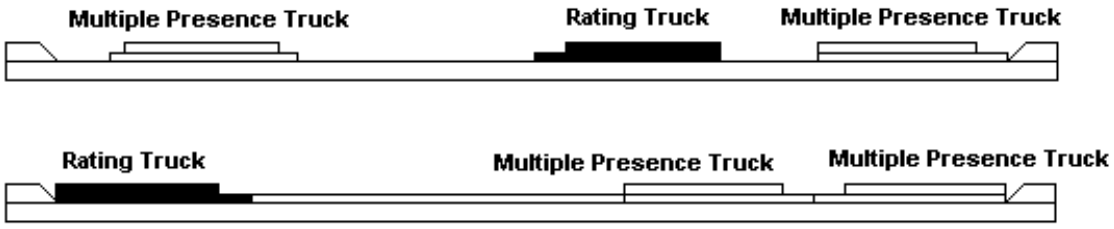
BRASS-GIRDER automatically places transversely the TWLRs on a floorbeam to calculate the live load effects. One or more sets of TWLRs are placed upon the floorbeam in many possible positions so that the controlling position is determined. See figures below.



Load Positioning



For the above, the lanes are placed in all possible positions with the wheel lines within the lanes set in all possible positions for each case. For example, the combinations below are included in the analysis:



The factors that are involved in determining possible positions are:

a. Width and position of travel way(s). This defines the location of curbs or curb to median, etc.
b. Distance between TWLRs (axle gauge) which is usually six feet.
c. Number of TWLRs which is usually two but can be as many as 20.
d. Traffic lane width, which is generally 12 feet as specified in AASHTO 3.6.2, but could be wider for an overload truck with a wheel gage greater than the typical six feet.
e. Number of traffic lanes to be allowed on the floorbeam. This value is computed, but may be defined by the user. For example, the user may require that a large overload be the only load permitted on the bridge at the time of crossing. In another case, the user may want one or more additional trucks to be on the bridge at the same time the truck being rated is on the bridge.
f. Additional multiple presence truck(s) (MPTs) for multiple presence analysis are additional TWLRs for the truck(s) to be placed in adjacent traffic lanes. These truck(s) could be the same as the

primary truck being rated, or may be different, such as the placement of a typical vehicle next to a permit vehicle. The number of MPTs will be the number of traffic lanes minus one, or as limited by the user. The user may define up to 10 rating trucks and 10 MPTs so that each primary truck may have a specific MPT.

g. The location of the floorbeam with respect to the travelway must be defined. This is done using the FLOORBEAM-TRAVELWAY command.
h. Primary rating truck lane width (design lane). This is generally ten feet as specified in AASHTO Figure 3.7.6A but can be wider for a permit truck with a wheel gage greater than the normal six feet.
i. MPT load lane width. This is generally ten feet as specified in AASHTO Figure 3.7.6A but could be wider for a truck with a wheel gage greater than the normal six feet.
j. The increment of movement distance (step) may be controlled by the user. Lanes and truck positions within lanes are shifted by the "step" for each load case. This step distance defaults to one foot.

Based on the above information, BRASS-GIRDER automatically places one or more sets of TWLRs (primary and MPTs) on a floorbeam in many positions and calculates maximum and minimum actions and the associated load ratings at each 1/10 point along the floorbeam, or at special points of interest as specified by the user.

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830	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DEAD-LOAD	DLD
PURPOSE	This command controls the output of actions and displacements and defines superstructure dead loads and temperature change. If performing a prestressed girder DESIGN analysis, see Note 2. This command is always required.	
7 COMMAND PARAMETERS		
Output Control Default = 1	This parameter may be used to reduce the amount of program output. If coded: 0 = No moments, shears, reactions, or deflections output. 1 = Moments, shears, reactions, and deflections at 1/10 points will be printed. 2 = Moments, shears, reactions, and deflections at all node points will be printed. 3 = Moments, shears, reactions, deflections, and concurrent actions at 1/10 points will be printed. 4 = Moments, shears, reactions, deflections, and concurrent actions at all node points will be printed. 5 = Moments, shears, reactions, deflections, and interactions will be printed (future capability - not currently operational). If the second parameter of the DECK-CON command was non-blank, then the stage 1 dead load to the girder will be automatically applied based on the weight of the deck as distributed to the analysis girder. If there is no stage construction, always use stage 1.	
Stage 1 Superstructure Dead Load Default = Load as calculated in deck component.	If the DECK-CON option was not used, enter the uniform dead load per foot in kips/ft. to be applied in stage 1. This will generally be the distributed weight of the deck concrete (composite or non-composite) on the analysis girder.	
Stage 2 Superstructure Dead Load Default = Load as calculated in deck component.	This parameter is for defining stage 2 superstructure dead loads. It is not required for non-stage construction or if the DECK-CON option was used and it would generally be used to apply sustained superstructure loads such as curbs and railing to a composite girder. Enter in kips/ft.	
Stage 3 Superstructure Dead Load Default = Load as calculated in the deck component.	This parameter is for entering stage 3 superstructure dead loads. It is not required for non-stage construction or if the DECK-CON option was used. It would generally be used to apply prestressing loads to the girder in stage 3 of construction. Enter in kips/ft. See Note 4.	
Δ T (Continued)	Enter the change in temperature in degrees Fahrenheit if the actions due to temperature change are desired. See Notes 1, 3, and 6.	

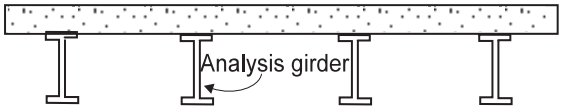
COMMAND PARAMETERS (Cont.)	
Additional Self-weight (F/L)	Enter an additional self-weight (in terms of force per unit length, k/ft) to be applied to the girder in stage 1. This value may be positive or negative. See Note 4.
Additional Self-weight (%)	Enter an additional self-weight (in terms of percentage) to be applied to the girder in stage 1. This value may be positive or negative. See Note 4.

EXAMPLE

For the loading described below, the DEAD-LOAD command would be coded as follows assuming full output is desired and no temperature change to be analyzed:

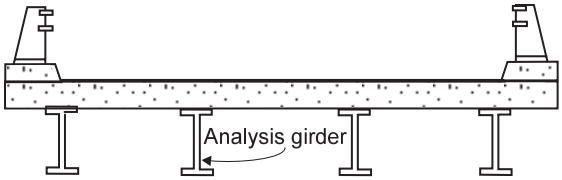
DEAD-LOAD 3, 1.123, 0.092

FIGURES



Stage 1

Weight of deck to non-composite analysis girder.



Stage 2

Weight of curb, rail and wearing surface to composite analysis girder.

NOTES

1. A positive value of Δ T denotes a temperature increase.

2. For prestressed design only, superstructure dead load for Stage 2 is defined in the PRESTRESS-3 command (1181). Any value entered in parameter 3 will be overwritten by the PR3 command. See command 1181 (PR3) for definition of Stage 2 dead loads. The DLD command is still required for BRASS-GIRDER™ to run. For example, a typical entry might resemble the following line:

   DLD 1,0.0,0.0,

3. BRASS-GIRDER™ applies settlement loads, temperature loads, and group loads (see LOAD-DESCR command) to the structure and calculates the resulting actions. The load effects are printed as separate load cases and are combined with dead load actions for the calculation of stresses with the same load factors as applied to dead load. If the user desires a different load factor for settlement and/or temperature, multiply the settlement (temperature) by that factor prior to input.

(Continued)

NOTES (Cont.)

4. For the load factor analysis of steel girders, BRASS does not analyze stage 3 dead loads. Treat temporary stage 3 dead loads, such as temporary concrete traffic barriers, as stage 2 dead loads.

5. Total self-weight will be computed as:

$$TSW = [GW \times (1 + ASWP/100)] + ASWF$$

where:

TSW = total self weight (force/length)
GW = girder self-weight (force/length)
ASWP = additional self-weight in terms of percentage
ASWF = additional self-weight in terms of force per unit length

6. BRASS cannot analyze a prestressed concrete girder bridge if the temperature change load is applied to the continuous stage, **AND**, the girders are simple span made continuous for live load, **AND**, the support conditions are pinned at more than only the left support.

840	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	LOAD-DESCR	LDE
PURPOSE	This command labels the load groups to help clarify program output. This refers directly to the load group number as defined on either the UNIFORM-DL1 or POINT-DL commands. This command may be repeated as needed to describe up to 4 different load groups. See Notes. It is optional.	
4 COMMAND PARAMETERS		
Load Group Number	Enter a number from 1 to 4 representing the load group to be named by the following parameter.	
Stage Default = 1	Enter the stage in which this load group is applied.	
Time of Application	Enter the time in days of application of this load group from initial prestressing if this is a prestressed concrete girder.	
Load Group Name	Enter up to 40 characters describing the load group.	

EXAMPLE

If “load group” #1 was used to represent a slab pour sequence, in Stage 1, on a nonprestressed girder bridge, it could be named by using the LOAD-DESCR command as follows:

LOAD-DESCR 1, 1, , SLAB POUR-SEQUENCE ONE

FIGURES

NOTES

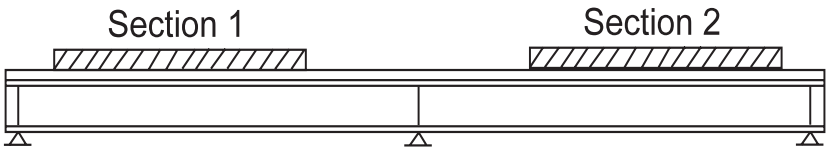
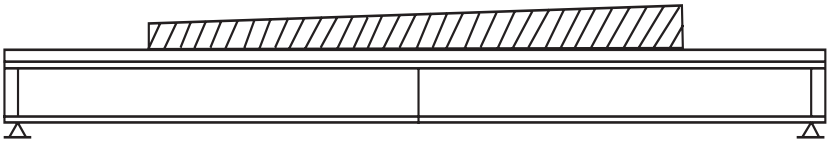
1. Only 3 group loads are allowed for prestress girders.

2. Do not use this command when using the Kansas Prestress Design module.

3. For precast, prestressed box beams, with integral diaphragms, see Parameter 8 of the PROPERTIES-PC1 command.

850	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	UNIFORM-DL1	UL1

PURPOSE	This command defines uniform loads to be applied to the structure. This command could be used in lieu of or in conjunction with parameters 2, 3, & 4 of the DEAD-LOAD command to describe slab placement sequence. This command is optional.
5 COMMAND PARAMETERS	
Span Number	Dead loads applied to the structure may be organized into load groups. A load group may be composed of uniform and/or point loads. In the case of a prestressed concrete girder bridge, only 3 load groups are allowed and the 4th is reserved for prestressing loads. Each load group may have up to 38 sections, a section being as shown below:  A UNIFORM-DL1 and UNIFORM-DL2 would be required to describe each section. Non-uniform distributed loads as shown below may be input, however, they must begin and end at a node point. The HINGE and/or TRANSFER commands may be used to add additional node points (additional analysis points). Enter the span number which that section of uniform load to be  described is placed. If the load is on top spans, this parameter may be left blank.
D_{LEFT} (Continued)	Enter the distance if feet from the left end of the span to the beginning point of this section of the distributed load. If the load is on top spans, then enter the distance from the left end of the bridge and leave span number blank. If the load varies, the beginning point must be at a node point.

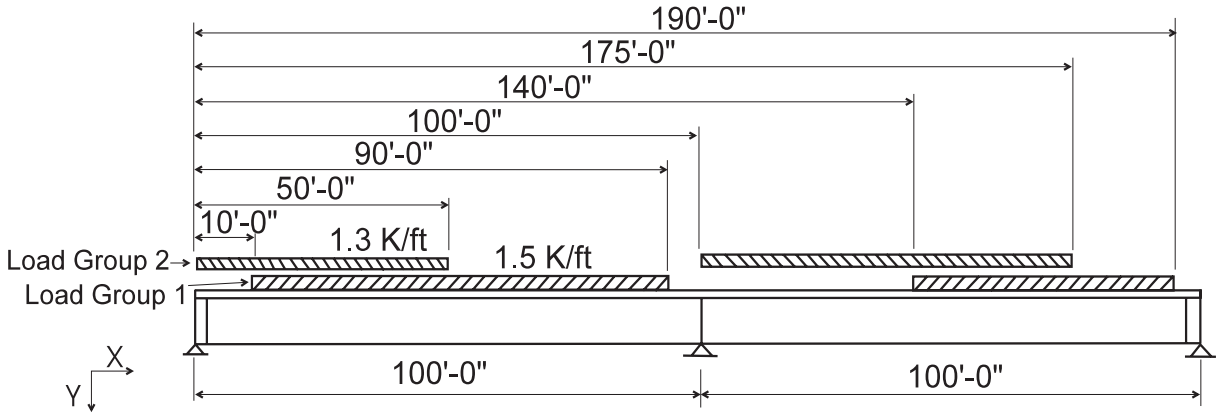
COMMAND PARAMETERS (Cont.)	
M_{LEFT}	Enter the magnitude in kips per foot at the left end of this section of the distributed load. If the load varies, then this starting point must be at a node point. Node points are automatically placed at span 1/10th points, at all cross section change points, at hinge points and at special analysis points as described by the HINGE or TRANSFER command. Negative loads are allowable. See Notes.
D_{RIGHT}	Enter the distance in feet from the left end of the span to the ending point of this section of the distributed load. If the load is on top spans, then enter the distance from the left end of the bridge and leave span number blank.
M_{RIGHT} Default = M_{LEFT}	Enter the magnitude in kips per foot at the right end of this section of the distributed load. If the load varies, then this ending point must be at a node point. Negative loads (upward) are allowable. See Notes.

EXAMPLE

For the loading shown if Figure 1, the UNIFORM-DL1 command would be used as follows:

LOAD-DESCR	1,	,	,	LOAD GROUP No. 1	1.5 K/Ft.
UNIFORM-DL1	,	10,	1.5,	90	
UNIFORM-DL1	,	140,	1.5,	190	
LOAD-DESCR	2,	2,	,	LOAD GROUP No. 2	1.3 K/Ft. STAGE 2
UNIFORM-DL1	,	0.0,	1.3,	50	
UNIFORM-DL1	,	100,	1.3,	175	

FIGURES

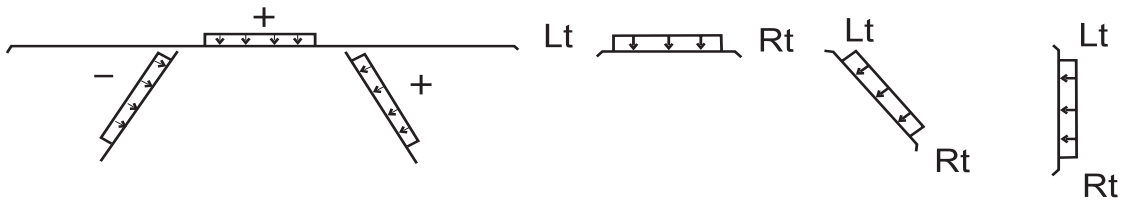


Load group 1 to be placed in stage 1 of construction and load group 2 to be placed in stage 2 of construction.

NOTES

Loads always act normal to the member. "Positive" deflections are down relative to the member.

Example:



Positive Loads

Do not use this command when using the Kansas Prestress Design module.

860	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	POINT-DL	PTD
PURPOSE	This command defines concentrated dead loads to be applied to the structure. This command may be repeated as needed to describe up to 70 point loads in each load group.	

4 COMMAND PARAMETERS

P_X	Enter the magnitude of the x component of the point load in kips based on the axis as shown in Figure 1.
P_Y	Enter the magnitude of the y component of the point load in kips based on the axis as shown in Figure 1.
Span Number	Enter the span number upon which the point load is acting. If the load is on a top span, this parameter may be left blank.
Distance	Enter the distance from the left end of the span to the point of application of the load. If span number was left blank, enter the distance from the left end of the bridge.

EXAMPLE

To apply the point loads to a structure as described below in Figure 2, the POINT-DL command would be used as follows:

```
POINT-DL      ,      12,      ,      18
POINT-DL      ,      6,       ,      72
```

FIGURES

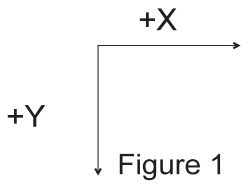


Figure 1

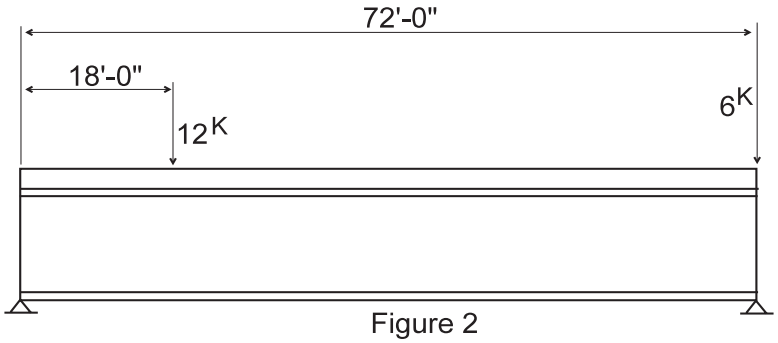


Figure 2

"Positive" vertical deflections are down.

NOTES

Do not use this command when using the Kansas Prestress Design module.

870	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	TEMP-SETL	TSL
PURPOSE	This command controls the stage(s) of construction in which forces due to temperature and/or settlement are applied. This command is optional. See the DEAD-LOAD command.	

2 COMMAND PARAMETERS

Stage $_T$ Default = 1	Enter the stage of construction in which the forces due to temperature change are to be applied to the structure. See Notes.
Stage $_S$ Default = 1	Enter the stage of construction in which the forces due to settlement are to be applied to the structure.

EXAMPLE

Assume that a composite steel and concrete bridge is constructed in 3 stages. The dead load on the non-composite girder (stage 1), the sustained dead load on the composite section allowing for creep (stage 2), and the live load on the composite section (stage 3), no creep. It would be reasonable to apply temperature change in stage 3 as it is not a long term sustained load and apply settlement in stage 2.

TEMP-SETL 3, 2

FIGURES

NOTES

BRASS cannot analyze a prestressed concrete girder bridge if the temperature change load is applied to the continuous stage, **AND**, the girders are simple span made continuous for live load, **AND**, the support conditions are pinned at more than only the left support.

880	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	LIVE-LOAD	LLD
PURPOSE	This command controls the application of live loads and sidewalk live loads to the structure. This command is required for live load analysis. IMPORTANT: Read page 13.1a for a description of the live load algorithm.	
8 COMMAND PARAMETERS		
Direction Control Default = 3	This parameter may be used to reduce the execution time. If the structure is symmetrical longitudinally about its midpoint, it is only necessary to move a truck up milepost or down milepost. If the structure is not symmetrical longitudinally but traffic only moves in one direction then only use the direction of traffic to reduce run time. If the structure is not symmetrical longitudinally and traffic moves both directions then use both directions. Codes: 1. Traffic moves up milepost (left to right). 2 Traffic moves down milepost (right to left). 3. Traffic moves both directions.	
Wheel Fraction	Enter the decimal fraction of a wheel line that is to be applied to the girder being analyzed. See AASHTO 3.23. See Notes.	
% Impact Default = 100	Enter the percent of impact to be used. BRASS will calculate the impact to be used as per AASHTO 3.8.2.1. This parameter may be used to reduce or increase that impact. For example, if it is planned to move an overload truck over the structure at a very slow speed, it may be desired to enter 0.0 in this parameter which would in effect take out all the impact. If a bridge deck is extremely rough it may be desirable to increase the impact by say 25 %. This parameter would then be entered as 125.	
Point Load and Wheel Advancement Denominator Default = 100 (Continued)	BRASS-GIRDER™ places a unit load at incremental distances across the deck spans. The influence of this unit load is used to generate live load actions. To obtain reasonable accuracy and run time this value defaults to 1/100 of the length of span 1. To reduce run time a smaller denominator may be input such as 50 then 1/50 of the length of span 1 will be used. *To obtain more precise answers input a larger denominator. On occasion slight asymmetry of live load actions is exhibited where expected. In such cases increase this parameter to improve the accuracy.*	

COMMAND PARAMETERS (Cont.)	
Sidewalk Load	If sidewalk live load is to be applied to the girder, enter the amount in lbs. per foot. BRASS will position this loading for maximum effect. A "fraction of sidewalk live load" similar to a truck wheel fraction is set to 1.0 by BRASS. See NOTES, Page 13.16.
Standard Truck	Code 1 if it is desired to analyze the structure for an AASHTO HS20 truck load and an AASHTO HS20 lane load. These truck loads will be automatically numbered Truck #1 and Truck #2. If subsequent trucks are entered using the TRUCK-CODE1, SPECIAL-TRUCK or SPECIAL-LANE commands, number these trucks beginning with Truck #3. If no other live loads are desired omit further live load commands. Note: If this is used in conjunction with a bridge deck analysis, two trucks must be entered in the bridge deck analysis.
Fixed Impact Factor Default = AASHTO Article 3.8.2, EQ. (3-1)	Code a fixed impact factor if a constant factor (independent of span length) is to be used, otherwise leave blank for AASHTO default. For example, a 20 percent increase due to impact should be entered as 0.20. Parameter No. 3, % Impact, is used in conjunction with this command. For example, % impact = 50 and Fixed Impact = 0.20, then the net impact factor is 0.50 (0.20) + 1 = 1.10.
Fixed Truck Position	This parameter allows the user to obtain ratings for a truck sitting in a fixed position. Code the distance, in feet, from the left end of the bridge to the front axle of the truck. IMPORTANT: There can only be one truck input and the Directional Control (Parameter 1) must be coded "1" (Traffic moves up milepost (left to right)).

EXAMPLE

For a typical girder with no sidewalk loading, longitudinal symmetry, and no desired change to impact or wheel advancement increment:

LIVE-LOAD 1, 1.5455

Wheel fraction assumed. $\frac{\text{Girder spacing}}{5.5} = \frac{8.5}{5.5} = 1.5455$

FIGURES

NOTES

Sidewalk live load is applied as an additional truck load with a wheel fraction of 1.00 and no impact. Sidewalk live load is always the last live load, i.e., if there are 6 live loads (trucks and/or lane loads) sidewalk live load will be considered as "truck #7". Also, sidewalk live load counts as one when considering the maximum of 10 live loads.

See AASHTO 3.14 and 3.22 when evaluating the effects of live load. BRASS-GIRDER™ does not add stresses due to sidewalk live load to the stresses due to dead load and truck live loads and compare to 125 % allowable stress.

The deflections output by BRASS-GIRDER™ include the effects of impact and scaled by the same wheel fractions as the live load actions. BRASS makes no compensation for deflection based on multiple girders or total section I. The engineer can obtain deflections based on other distribution by proportioning the wheel fractions.

900	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	TRUCK-WFR	TRW
PURPOSE	This command assigns individual wheel fractions to trucks. Input parameters in this command will override parameter -2- of the LIVE-LOAD command. This command is optional. It may be repeated if needed for trucks 7 through 10.	

6 COMMAND PARAMETERS

WFR $_{1\ (OR\ 7)}$	Enter the wheel fraction to be applied to the wheel line weights of truck number 1. (or truck number 7).
WFR $_{2\ (OR\ 8)}$	Enter the wheel fraction to be applied to the wheel line weights of truck number 2. (or truck number 8).
WFR $_{3\ (OR\ 9)}$	Enter the wheel fraction to be applied to the wheel line weights of truck number 3. (or truck number 9).
WFR $_{4\ (OR\ 10)}$	Enter the wheel fraction to be applied to the wheel line weights of truck number 4. (or truck number 10).
WFR $_{5}$	Enter the wheel fraction to be applied to the wheel line weights of truck number 5.
WFR $_{6}$	Enter the wheel fraction to be applied to the wheel line weights of truck number 6.

EXAMPLE

Assume it is desired to override the wheel fraction to be used on trucks #3, 8, & 9:

```
TRUCK-WFR  ,,1.40
TRUCK-WFR  ,1.40,1.40
```

FIGURES

NOTES

910	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	TRUCK-IMP	TRI
PURPOSE	This command assigns individual percents of impact to be applied to truck loadings. Input parameters in this command will override parameter -3- of the LIVE-LOAD command. This command is optional. It may be repeated if needed for trucks 7 through 10.	

6 COMMAND PARAMETERS

$IMP_{1\ (OR\ 7)}$	Enter the percent of impact to be applied to truck number 1. (or 7).
$IMP_{2\ (OR\ 8)}$	Enter the percent of impact to be applied to truck number 2. (or 8).
$IMP_{3\ (OR\ 9)}$	Enter the percent of impact to be applied to truck number 3. (or 9).
$IMP_{4\ (OR\ 10)}$	Enter the percent of impact to be applied to truck number 4. (or 10).
IMP_{5}	Enter the percent of impact to be applied to truck number 5.
IMP_{6}	Enter the percent of impact to be applied to truck number 6.

EXAMPLE

Assuming that trucks #4 and 8 are special overload trucks that are restricted to 35 mph over structures and impact is to be reduced by ½ (50 %).

```
TRUCK-IMP       ,       ,       ,       50
TRUCK-IMP       ,       50
```

FIGURES

NOTES

920	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	TRUCK-CODE1	TR1
PURPOSE	This command defines truck loads by a "truck code". This truck code must have been previously stored in the Truck Library along with axle weight and spacing data defining the truck. Trucks may be specified by use of this command and/or the SPECIAL-TRUCK and SPECIAL-LANE commands. See command 1240 for an explanation of printing the Truck Library.	

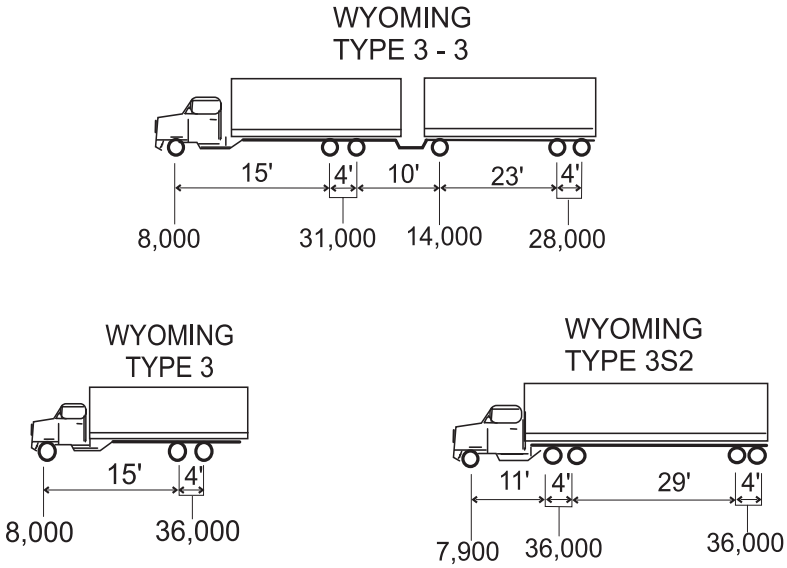
6 COMMAND PARAMETERS

Truck Code 1	Enter the code for the first truck to be applied to the structure.
Truck Code 2	Enter the code for the second truck to be applied to the structure.
Truck Code 3	Enter the code for the third truck to be applied to the structure.
Truck Code 4	Enter the code for the fourth truck to be applied to the structure.
Truck Code 5	Enter the code for the fifth truck to be applied to the structure.
Truck Code 6	Enter the code for the sixth truck to be applied to the structure.

EXAMPLE

TRUCK-CODE1 HS20T, TYPE3, MILITARY, DUMP1

FIGURES



NOTES

AASHTO (TYPE 3, TYPE 3S2, and TYPE 3-3) and Wyoming rating trucks (WYOTYPE 3, WYOTYPE3S2, and WYOTYPE 3-3 shown above) represent just a few of the types of trucks that are already coded in the truck library.

There should be a direct correlation between the first truck applied here and the first truck's wheel weight applied by the DECK-TRK1 command. The same applies to the second through tenth trucks as well. The number of trucks must also agree.

930	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	TRUCK-CODE2	TR2
PURPOSE	This command defines truck loads 7 through 10 by a "Truck Code". This truck code must have been previously stored in the Truck Library along with axle weight and spacing data defining the truck. Trucks may be specified by use of this command and/or the SPECIAL-TRUCK and SPECIAL-LANE command. See command 1240 for an explanation of printing the Truck Library.	

4 COMMAND PARAMETERS

Truck Code 7	Enter the code for the seventh truck to be applied to the structure.
Truck Code 8	Enter the code for the eighth truck to be applied to the structure.
Truck Code 9	Enter the code for the ninth truck to be applied to the structure.
Truck Code 10	Enter the code for the tenth truck to be applied to the structure.

EXAMPLE

```
TRUCK-CODE2          MX,     MXC,     MILITARY,     SINGLE
```

FIGURES

NOTES

940	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	SPECIAL-TRUCK	STR
PURPOSE	This command defines a truck that is not stored in the "Truck Library". It may be repeated as needed to define a truck with up to 24 axles and up to 10 trucks may be defined if all 10 are defined by this command. It may be used in conjunction with the TRUCK-CODE1 and TRUCK-CODE2 or SPECIAL-LANE commands.	

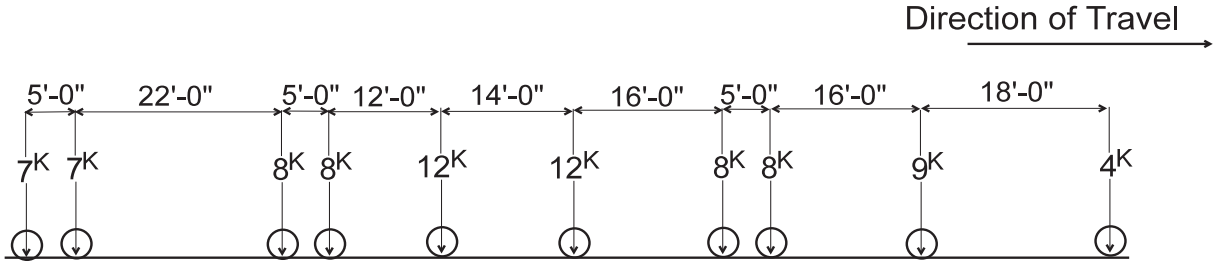
6 COMMAND PARAMETERS	
Truck Number	Enter the number of the truck to be defined by this command. It cannot be a number already defined by the TRUCK-CODE1, TRUCK-CODE2, or SPECIAL-LANE commands.
Truck Wheel Load 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, or 23	Enter the truck wheel load in kips of the first wheel if this is the first command, the third wheel load if the second command, the fifth wheel load if the third command, etc.
Wheel Spacing 1-2, 3-4, 5-6, 7-8, 9-10, 11-12, 13-14, 15-16, 17-18, 19-20, 21-22, or 23-24	Enter the spacing in feet between the first and second wheels if this is the first command, the third and fourth if this is the second command, the fifth and sixth if this is the third command, etc.
Truck Wheel Load 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, or 24	Enter the truck wheel load in kips of the second wheel if this is the first command, the fourth wheel if the second command, the sixth wheel if the third command, etc.
Wheel Spacing 2-3, 4-5, 6-7, 8-9, 10-11, 12-13, 14-15, 16-17, 18-19, 20-21, or 22-23	Enter the spacing in feet between the second and third wheels if this is the first command, the fourth and fifth if the second command, the sixth and seventh if the third command, etc.
HS Type Truck	Enter 1 if this is an HS type truck with variable rear axle spacing to 30'. Only required once.

EXAMPLE

For the truck shown if Figure 1 below the SPECIAL-TRUCK command would be used as follows:

```
SPECIAL-TRUCK 1,    4,    18,    9,    16
SPECIAL-TRUCK 1,    8,    5,     8,    16
SPECIAL-TRUCK 1,    12,   14,    12,   12
SPECIAL-TRUCK 1,    8,    5,     8,    22
SPECIAL-TRUCK 1,    7,    5,     7
```

FIGURES



Wheel loads shown in kips.

NOTES

The number of the truck entered in this section must agree with the number specified in Section 7, Bridge Deck Analysis. Truck numbers must be consecutive beginning with any trucks input previously. For example, if three trucks were entered on the TRUCK-CODE1 command, then the first truck number entered by this command must be number 4. Negative axle loads or axle loads of 0.0 are not allowed.

950	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	SPECIAL-LANE	SLN
PURPOSE	This command describes a lane load that is not stored in the "Truck Library". It may be repeated if more than one lane load is needed to be defined by this command.	

5 COMMAND PARAMETERS

Truck No.	Enter the number of the truck to be defined by this command. It cannot be a number already defined by the TRUCK-CODE1, TRUCK-CODE2, or SPECIAL-LANE commands.
Uniform Lane Load	Enter the uniform lane load in kips per foot equivalent to one wheel line. This would be ½ of the lane load as usually described.
Concentrated Load for Shear	Enter the concentrated load for shear in kips equivalent to a wheel line. This would be ½ of the concentrated load for shear as usually described.
Concentrated Load for Moment	Enter the concentrated load for moment in kips equivalent to a wheel line. This would be ½ of the concentrated load for moment as usually described.
Truck Weight (Optional)	Enter the total weight of the truck in tons.

EXAMPLE

For the lane load shown in Figure 1, the SPECIAL-LANE command would be as follows:

SPECIAL-LANE 1, 0.36, 14.5, 10

FIGURES

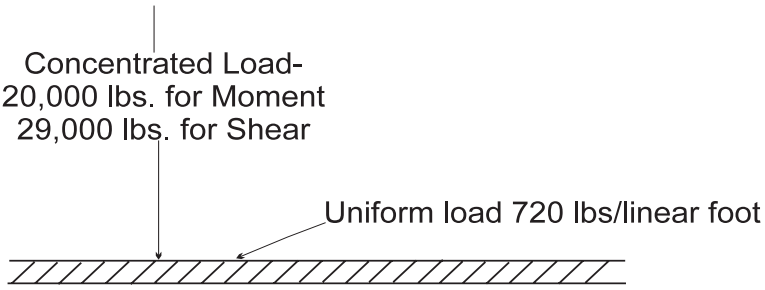


Figure 1

NOTES

Note: The number of trucks entered in this section must agree with the number specified in Section 7, Bridge Deck Analysis. Truck numbers must be consecutive beginning with any trucks input previously. For example, if three trucks were in the TRUCK-CODE1 command, then the first truck entered by this command must be number 4.

960	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	AXLE-WF	AWF
PURPOSE	This command allows the user to override the wheel fraction for any axle on any truck. This command is optional and may be repeated as many times as needed. NOTE: This command may be used only for truck loads, no lane loads.	

3 COMMAND PARAMETERS	
Truck No.	Enter the number of the truck to override the wheel fraction. See Notes.
Axle No.	Enter the axle number of the truck, starting from the front.
Wheel Fraction	Enter the wheel fraction to be applied for this axle.

EXAMPLE

```
DEAD-LOAD       1, 1.031
LIVE-LOAD       3, 1.37
TRUCK-CODE1     TYPE3,  LANEHS20,  TYPE3-3
COMMENT
COMMENT         SET WHEEL FRACTIONS FOR AXLE 2 AND 3 ON THE TYPE3
COMMENT         TRUCK TO 1.75
COMMENT
AXLE-WF         1, 2, 1.75
AXLE-WF         1, 3, 1.75
COMMENT
COMMENT         SET WHEEL FRACTIONS FOR AXLE 4 AND 5 ON THE TYPE3-3
COMMENT         TRUCK TO 1.75
COMMENT
AXLE-WF         3, 4, 1.75
AXLE-WF         3, 5, 1.75
```

FIGURES

NOTES

Truck numbers are assigned sequentially from the TRUCK-CODE1 and TRUCK-CODE2 commands. In the example above, the TYPE3 truck is #1, the LANEHS20 is #2, and the TYPE3-3 truck is #3. If a “1" is entered in parameter 6 of the LIVE-LOAD command (which instructs BRASS to analyze the HS-20T and LANEHS20 loads) they will be automatically numbered truck #1 and truck #2. If subsequent trucks are entered using the TRUCK-CODE1, SPECIAL-TRUCK or SPECIAL-LANE commands, these trucks are numbered beginning with truck #3.

970	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	FLOORBEAM-CONTROL	FBC
PURPOSE	This command controls the analysis parameters for a floorbeam rating.	

5 COMMAND PARAMETERS	
Increment of Movement Default = 1.0 foot	Enter the distance lanes and axles within lanes will be moved each time as they are 'stepped' across the floorbeam as maximum actions are sought. The smaller the number, the finer the analysis, but run time will increase. See Note 1.
Unit Point Load Advancement Denominator Default = 50	BRASS-GIRDER places a unit load at incremental distances across the floorbeam spans. The influence of this unit load is used to generate live load actions for each truck's transverse wheel line weights. To obtain reasonable accuracy and run time this value defaults to 1/50 of the length of span 1 of the floorbeam. NOTE: If the first span of the floorbeam is a short cantilever, a denominator value producing an advancement length of one foot or less would be reasonable. To reduce run time a smaller denominator may be input, such as 25, then 1/25 of the length of span 1 will be used. To obtain more precise answers input a larger denominator. On occasion slight asymmetry of live load actions is exhibited where expected. In such cases increase this parameter to improve the accuracy.
% Impact Default = 100%	Enter the percent of impact to be used. BRASS will calculate the impact to be used per AASHTO Article 3.8.2. This parameter may be used to reduce or increase that impact. For example, if it is planned to move an overload truck over the bridge at a very low speed, it may be desired to enter 0.0 for this parameter which would in effect take out all the impact. If, for example, the bridge deck is extremely rough, it may be desirable to increase the impact 25%. This parameter would then be entered as 125. See Note 2.
Fixed Impact Factor Default = AASHTO Article 3.8.2	Enter a fixed impact factor if a constant factor (independent of span length) is to be used, otherwise leave blank for the AASHTO default. For example, a 20 percent increase in live load effect due to impact should be entered as 0.20. Parameter #3, '% Impact', is used in conjunction with this command. For example, if % Impact = 0.20, then the net impact factor is (0.50 x 0.20) + 1 = 1.10. See Note 2.
Output Control	Enter 1 to obtain the output of the location and weight of wheel lines for each position at which loads are applied to the floorbeam during analysis for maximum actions.

EXAMPLE

For the following bridge floorbeam configuration shown in Figure 1, the typical input would be:

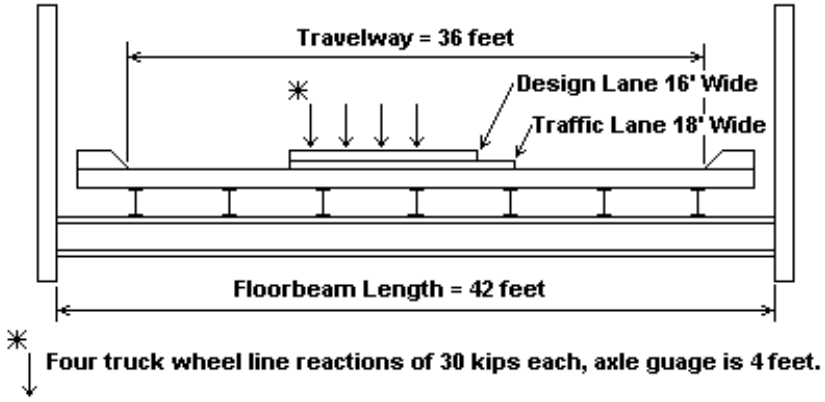
FLOORBEAM-CONTROL 1, 100, 100, , 1
FLOORBEAM-TRAVELWAY 1, 3, 36
FLOORBEAM-TRUCK 1, PD-1, 100, 16, 18, 2, 1, 42, Piedmont Heavy No.1
FLOORBEAM-TRUCK-AXLE 1, 30, 4, 30, 4, 30, 4, 30

FIGURES

Step 1 - Performed before this analysis

Piedmont Trucking
Wheel line reaction (WLR) determined from separate
analysis of the stringers or deck spanning the floorbeams

Step 2 - Analyze Floor Beam


Travelway = 36 feet
Design Lane 16' Wide
Traffic Lane 18' Wide
Floorbeam Length = 42 feet
Four truck wheel line reactions of 30 kips each, axle guage is 4 feet.

NOTES

1. The increment of movement distance (step) may be controlled by the user. Lanes and truck positions within lanes are shifted by the "step" for each load case. This step distance defaults to one foot.

2. The parameters for impact on this command may be overridden by using the similar parameters on the FLOORBEAM-TRUCK command if it is desired to use different impacts for individual rating trucks.

972	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	FLOORBEAM-TRAVELWAY	FBW
PURPOSE	This command may be repeated for additional travelways. Note: If more than one travelway is entered, the median width is the distance to the left edge of the right travelway minus the distance to the right edge of the left travelway. Travelways may not overlap.	
3 COMMAND PARAMETERS		
Travelway Number Default = 1	Enter the number of the travelway. Number the travelways in sequential ascending order beginning with the leftmost travelway as number 1.	
Travelway Start Distance (feet) Default = 0.0	Enter the distance to the left edge of the travelway.	
Travelway width (feet)	Enter the width of the travelway.	

EXAMPLE

For the following bridge floorbeam configuration shown in Figure 1, the typical input would be:

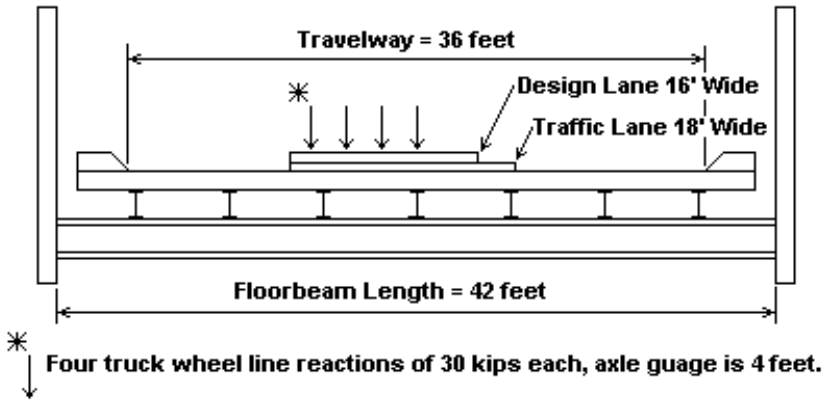
FLOORBEAM-CONTROL 1, 100, 100, , 1
FLOORBEAM-TRAVELWAY 1, 3, 36
FLOORBEAM-TRUCK 1, PD-1, 100, 16, 18, 2, 1, 42, Piedmont Heavy No.1
FLOORBEAM-TRUCK-AXLE 1, 30, 4, 30, 4, 30, 4, 30

FIGURES

Step 1 - Performed before this analysis

Piedmont Trucking
Wheel line reaction (WLR) determined from separate
analysis of the stringers or deck spanning the floorbeams

Step 2 - Analyze Floor Beam


Travelway = 36 feet
Design Lane 16' Wide
Traffic Lane 18' Wide
Floorbeam Length = 42 feet
Four truck wheel line reactions of 30 kips each, axle guage is 4 feet.

NOTES

974	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	FLOORBEAM-TRUCK	FBT
PURPOSE	This command defines the parameters associated with a rating truck set of wheel line reactions. It will always precede one or two FLOORBEAM-TRUCK-AXLE commands that will describe the wheel line reactions for the truck parameters entered with this command. Up to 10 trucks are allowed.	

9 COMMAND PARAMETERS	
Truck Number	Enter the number of the primary rating truck for which the following data applies.
Truck Name	Enter the truck name (code). Up to 12 characters are allowed.
% Impact Default = % entered on the FLOORBEAM-CONTROL command	Enter the percent of impact to be used. BRASS will calculate the impact to be used per AASHTO Article 3.8.2. This parameter may be used to reduce or increase that impact. For example, if it is planned to move an overload truck over the bridge at a very low speed, it may be desired to enter 0.0 for this parameter which would in effect take out all the impact. If, for example, the bridge deck is extremely rough, it may be desirable to increase the impact 25%. This parameter would then be entered as 125. See Note 1.
Design Lane Width (feet) Default = Axle Width + 4 Feet	Enter the width of the design lane for this rating truck.
Traffic Lane Width (feet) Default = Design Lane Width + 2 Feet	Enter the width of the traffic lane. See Note 2.
Maximum number of traffic lanes for this rating truck. Default = 1 + integer number of multi-presence lanes possible	Enter the maximum number of traffic lanes to be loaded for the rating of this truck on the floorbeam (up to 10 maximum). This will determine the number of multiple presence trucks allowed with this rating truck. See Page 13.33 for more information.
Multiple Presence Truck Number	Enter the number of the multiple-presence truck to be placed with this rating truck. Leave blank if no multiple-presence trucks to be used.
Truck Weight (Required)	Enter the total weight of the truck in tons. This will be used in the rating report.
Truck description	Enter a description for this rating truck. Up to 40 characters may be used.

EXAMPLE

For the following bridge floorbeam configuration shown in Figure 1, the typical input would be:

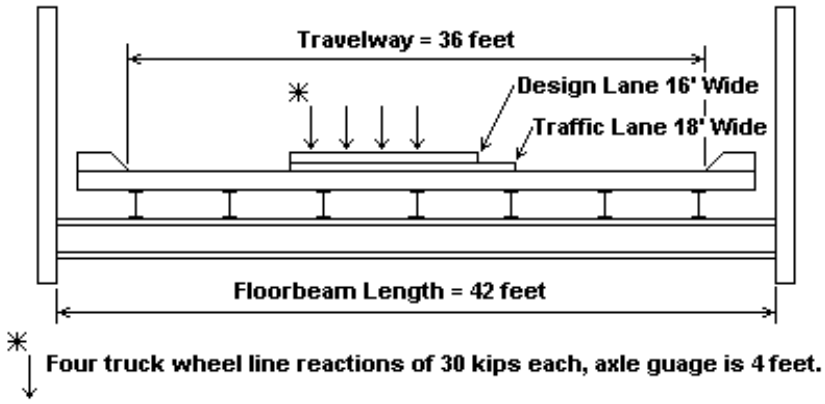
FLOORBEAM-CONTROL 1, 100, 100, , 1
FLOORBEAM-TRAVELWAY 1, 3, 36
FLOORBEAM-TRUCK 1, PD-1, 100, 16, 18, 2, 1, 42, Piedmont Heavy No.1
FLOORBEAM-TRUCK-AXLE 1, 30, 4, 30, 4, 30, 4, 30

FIGURES

Step 1 - Performed before this analysis

Piedmont Trucking
Wheel line reaction (WLR) determined from separate
analysis of the stringers or deck spanning the floorbeams

Step 2 - Analyze Floor Beam


Travelway = 36 feet
Design Lane 16' Wide
Traffic Lane 18' Wide
Floorbeam Length = 42 feet
Four truck wheel line reactions of 30 kips each, axle guage is 4 feet.

NOTES

1. The parameters for impact on this command will override the similar parameters on the FLOORBEAM-CONTROL command if it is desired to use a different impact for this rating truck.

2. Passing clearance is computed as (design lane width - axle width) / 2.

976	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	FLOORBEAM-TRUCK-AXLE	FBA
PURPOSE	Describe the axle (wheel line reactions and gauges) for a truck associated with a floor beam analysis. This command may be repeated if there are more than 6 wheel lines.	

13 COMMAND PARAMETERS	
Truck Number	Enter the number of the primary rating truck for which the following data applies.
Wheel Line Reaction 1 or 7 (kips)	Enter the wheel line reaction for the first wheel line if this is the first command. Enter the wheel line reaction for the seventh wheel line if this is the second command.
Gage 1 or 7 (feet) Default = 6 ft	Enter the distance from the first wheel line to the second wheel line if this is the first command. Enter the distance from the seventh wheel line to the eighth wheel line if this is the second command.
Wheel Line Reaction 2 or 8 (kips)	Enter the wheel line reaction for the second wheel line if this is the first command. Enter the wheel line reaction for the eighth wheel line if this is the second command.
Gage 2 or 8 (feet) Default = 6 ft	Enter the distance from the second wheel line to the third wheel line if this is the first command. Enter the distance from the eighth wheel line to the ninth wheel line if this is the second command.
Wheel Line Reaction 3 or 9 (kips)	Enter the wheel line reaction for the third wheel line if this is the first command. Enter the wheel line reaction for the ninth wheel line if this is the second command
Gage 3 or 9 (feet) Default = 6 ft	Enter the distance from the third wheel line to the fourth wheel line if this is the first command. Enter the distance from the ninth wheel line to the tenth wheel line if this is the second command.
Wheel Line Reaction 4 or 10 (kips)	Enter the wheel line reaction for the fourth wheel line if this is the first command. Enter the wheel line reaction for the tenth wheel line if this is the second command
(Continued)	

	COMMAND PARAMETERS (Cont.)
Gage 4 or 10 (feet) Default = 6 ft	Enter the distance from the fourth wheel line to the fifth wheel line if this is the first command. Enter the distance from the tenth wheel line to the eleventh wheel line if this is the second command.
Wheel Line Reaction 5 or 11 (kips)	Enter the wheel line reaction for the fifth wheel line if this is the first command. Enter the wheel line reaction for the eleventh wheel line if this is the second command
Gage 5 or 11 (feet) Default = 6 ft	Enter the distance from the fifth wheel line to the sixth wheel line if this is the first command. Enter the distance from the eleventh wheel line to the twelfth wheel line if this is the second command.
Wheel Line Reaction 6 or 12 (kips)	Enter the wheel line reaction for the sixth second wheel line if this is the first command. Enter the wheel line reaction for the twelfth wheel line if this is the second command
Gage 6 (feet) Default = 6 ft	Enter the distance from the sixth wheel line to the seventh wheel line if the seventh wheel line exists (repeat this command as needed to describe all wheel lines).

EXAMPLE

For the following bridge floorbeam configuration shown in Figure 1, the typical input would be:

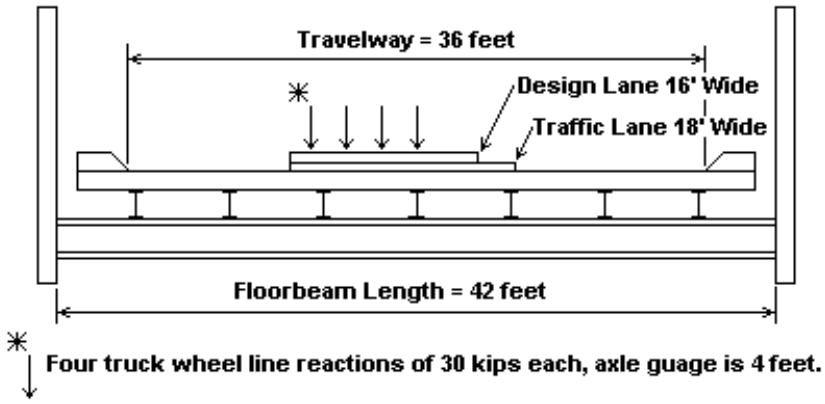
FLOORBEAM-CONTROL 1, 100, 100, , 1
FLOORBEAM-TRAVELWAY 1, 3, 36
FLOORBEAM-TRUCK 1, PD-1, 100, 16, 18, 2, 1, 42, Piedmont Heavy No.1
FLOORBEAM-TRUCK-AXLE 1, 30, 4, 30, 4, 30, 4, 30

FIGURES

Step 1 - Performed before this analysis

Piedmont Trucking
Wheel line reaction (WLR) determined from separate
analysis of the stringers or deck spanning the floorbeams

Step 2 - Analyze Floor Beam


Travelway = 36 feet
Design Lane 16' Wide
Traffic Lane 18' Wide
Floorbeam Length = 42 feet
Four truck wheel line reactions of 30 kips each, axle guage is 4 feet.

NOTES

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978	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	FLOORBEAM-MPT	FBM
PURPOSE	Describe lane widths and axles (wheel line reactions and gauges) for a multiple presence truck associated with a rating truck for floor beam analysis. This command may be repeated if there are more than 6 wheel lines.	

15 COMMAND PARAMETERS	
Multiple Presence Truck Number	Enter the number of the Multiple Presence Truck (MPT) for which the following TWRLs apply.
Design Lane Width (feet) Default = Axle Width + 4 Feet	Enter the width of the design lane.
Traffic Lane Width (feet) Default = Design Lane Width + 2 Feet	Enter the width of the traffic lane.
Wheel Line Reaction 1 or 7 (kips)	Enter the wheel line reaction for the first wheel line if this is the first command. Enter the wheel line reaction for the seventh wheel line if this is the second command.
Gage 1 or 7 (feet) Default = 6 ft	Enter the distance from the first wheel line to the second wheel line if this is the first command. Enter the distance from the seventh wheel line to the eighth wheel line if this is the second command.
Wheel Line Reaction 2 or 8 (kips)	Enter the wheel line reaction for the second wheel line if this is the first command. Enter the wheel line reaction for the eighth wheel line if this is the second command.
Gage 2 or 8 (feet) Default = 6 ft	Enter the distance from the second wheel line to the third wheel line if this is the first command. Enter the distance from the eighth wheel line to the ninth wheel line if this is the second command.
Wheel Line Reaction 3 or 9 (kips)	Enter the wheel line reaction for the third wheel line if this is the first command. Enter the wheel line reaction for the ninth wheel line if this is the second command
Gage 3 or 9 (feet) Default = 6 ft	Enter the distance from the third wheel line to the fourth wheel line if this is the first command. Enter the distance from the ninth wheel line to the tenth wheel line if this is the second command.

(Continued)

	COMMAND PARAMETERS (Cont.)
Wheel Line Reaction 4 or 10 (kips)	Enter the wheel line reaction for the fourth wheel line if this is the first command. Enter the wheel line reaction for the tenth wheel line if this is the second command
Gage 4 or 10 (feet) Default = 6 ft	Enter the distance from the fourth wheel line to the fifth wheel line if this is the first command. Enter the distance from the tenth wheel line to the eleventh wheel line if this is the second command.
Wheel Line Reaction 5 or 11 (kips)	Enter the wheel line reaction for the fifth wheel line if this is the first command. Enter the wheel line reaction for the eleventh wheel line if this is the second command
Gage 5 or 11 (feet) Default = 6 ft	Enter the distance from the fifth wheel line to the sixth wheel line if this is the first command. Enter the distance from the eleventh wheel line to the twelfth wheel line if this is the second command.
Wheel Line Reaction 6 or 12 (kips)	Enter the wheel line reaction for the sixth second wheel line if this is the first command. Enter the wheel line reaction for the twelfth wheel line if this is the second command
Gage 6 (feet) Default = 6 ft	Enter the distance from the sixth wheel line to the seventh wheel line if the seventh wheel line exists (repeat this command as needed to describe all wheel lines).

EXAMPLE

For the following bridge floorbeam configuration shown in Figure 1, the typical input would be:

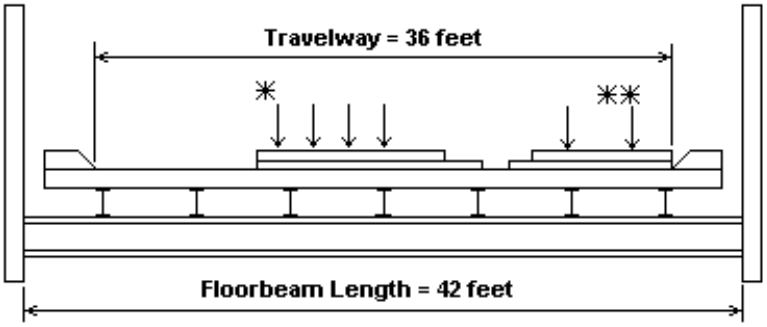
FLOORBEAM-CONTROL 1, 100, 100, , 1
FLOORBEAM-TRAVELWAY 1, 3, 36
FLOORBEAM-TRUCK 1, PD-1, 100, 16, 18, 2, 1, 42, Piedmont Heavy No.1
FLOORBEAM-TRUCK-AXLE 1, 30, 4, 30, 4, 30, 4, 30
FLOORBEAM-MPT 1, 10, 12, 20, 6, 20

FIGURES

Step 1 - Performed before this analysis

Multiple Presence Truck
Wheel line reaction (WLR) determined from separate
analysis of the stringers or deck spanning the floorbeams

Step 2 - Analyze floorbeam



✳ Four truck wheel line reactions of 30 kips each, axle guage is 4 feet.

✳✳ Two truck wheel line reactions for the multiple presence truck of 20 kips each, axle guage is 6 feet. The multiple presence truck is in a 10' wide design lane and 12' wide traffic lane.

NOTES

Passing clearance is computed as (design lane width - axle width) / 2..

14. GIRDER SECTION DESIGN AND RATING

The commands in this section are utilized to determine load effects for the cross section at specific points along the girder. Either a design analysis or a rating analysis may be performed at these points.

Up to 212 specific analysis points (points of interest) may be analyzed in one run. The commands required will depend upon the type of analysis desired and the type of girder material. The use of the commands associated with analysis points is optional and several alternatives for generating the analysis points and associated data are available. BRASS-GIRDER™ allows the user to either generate analysis points by using the schedule-based option (see Parameter 6 of the ANALYSIS command) based on 1/10 points and/or user specified points (see the POINT-OF-INTEREST command) or by entering appropriate sets of the following commands for steel, concrete, prestressed concrete or timber sections.

For prestressed concrete girders, no additional data on the PRESTRESS-1 thru PRESTRESS-2 commands are required other than the analysis point number. The POINT-OF-INTEREST and the INTERMEDIATE-OUTPUT commands will also work for prestress as long as the PRESTRESS-1 thru PRESTRESS-2 commands are used only to define the analysis point (i.e. PR1 104).

Note that the schedule-based input option is only valid for steel and non-prestressed concrete girders. Data entered in the steel and non-prestressed concrete girders schedule-based input may be overridden by using the STEEL-1, STEEL-2, STEEL-4, CONCRETE-1, or CONCRETE-2 commands.

Allowable Stress Levels

BRASS-GIRDER™ rates several elements such as flanges, bearing stiffeners, stirrups, reinforcing steel, etc. for up to 4 different stress levels. These are controlled by the INVENTORY, OPERATING, POSTING, and SAFE-LOAD commands.

There may be cases when the user does not want to rate one of these elements. If the input parameter giving the ratio of allowable stress over yield stress for the element has a default value, then enter a large value for that ratio so that the load rating factor for that element will be large (Working Stress analysis only). If the input parameter does not have a default value, either leave it blank or enter a large value for the ratio of allowable stress over yield stress. Load rating factors for elements that are not applicable or are to be ignored will be output as asterisks or “NA”.

980	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DESIGN	DES
PURPOSE	This command allows the user to control the type of analysis of girder sections at user specified analysis points. It also allows input of girder height for a lateral wind bracing check. It is required if the user desires an analysis of specified girder sections for stresses, load ratings, stiffener design, stirrup design, etc.	
3 COMMAND PARAMETERS		
Run Control and Report Type Default = 1	Enter 1 for BRASS to sort through the actions produced by each truck and perform a design only for the truck that produces the maximum action. See Notes 1 and 3. Also, enter 1 if an ultimate strength design of a steel girder splice is desired. Enter 2 if a review analysis is desired. This will generate a report of stresses due to each live load individually combined with dead load. Enter 3 if a rating analysis and report is desired. This will generate a report of stresses and a report of rating factors for each live load individually combined with dead load. See Note 1 and 2. Enter 4 to perform a design for each truck. See Notes 1 and 3.	
Analysis Method (Continued)	Enter 0 or blank for working stress (service load) analysis. Not valid for prestressed girders. If a strength design method (load factor) analysis is desired, enter one of the following option codes: Enter 1 if a load rating analysis of steel, concrete, or prestressed girder by the strength design method is desired (1st parameter = 3) or if a preliminary concrete design run (1st parameter = 1) by the strength design method is desired. A preliminary concrete design run will give required areas of reinforcing steel at locations throughout the bridge length for corresponding effective depths determined from calculations based upon the input data. Enter 2 if a final concrete design run is desired.	

COMMAND PARAMETERS (Cont.)	
Lateral Wind Bracing (Applicable to service load analysis of exterior composite steel girders only)	If this is the design of an exterior steel girder and a report of lateral wind bracing requirements [per AASHTO 10.20.2] is desired, enter the height in feet of structure above the girder that will be exposed to wind. BRASS will add the girder depth to this at each analysis point and check wind bracing requirements. Wind bracing requirements are based on the allowable stress in the bottom flange. The option can only be used with parameter 2 set to blank or 0 (service load).

EXAMPLE

For the rating of a bridge by the working stress design method, a typical DESIGN command would be coded as follows:

```
DESIGN      3
```

For the rating of a bridge by the strength design method, a typical DESIGN command would be coded as follows:

```
DESIGN      3,      1
```

FIGURES

NOTES

1. Requires an INVENTORY or LOAD-LEVEL-1 command.

2. In the case of composite structures, reports of stresses due to dead load actions will be output as well as live load stresses and combined stresses.

3. Currently BRASS can design transverse, longitudinal and bearing stiffeners for load factor (strength) design. If the user requires a design, leave the input parameters related to the dimensions of all three types of stiffeners blank. Also, leave the transverse stiffener spacing blank. When using the design option, only use the LOAD-LEVEL-1 command. Also, input a 1 or 4 in the first parameter of the DESIGN command.

   When the design is nearly finalized, run a rating using the girder and stiffener dimensions output and include the other LOAD-LEVEL-2 through 4 commands to check for serviceability, fatigue and overload. Be sure to input a 3 in the first parameter of the DESIGN command. The design can then be finalized with one or more iterations, as needed. NOTE: This option designs all three types of stiffeners. BRASS does not have the capability to design one or two types separately.

990	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	INVENTORY	INV
PURPOSE	This command controls the stress levels or load factors for determining the inventory rating or design of a girder. Select the parameters for Working Stress or Ultimate Strength as applicable. For steel ultimate strength analysis, use the LOAD-LEVEL-1 through LOAD-LEVEL-4 commands. **IMPORTANT:** See Note 1.	
6 OR 10 COMMAND PARAMETERS		
	Working Stress Analysis - For Steel Girders and Non-Prestressed Reinforced Concrete Girders, use the following 6 parameters.	
Rebar Default = 0.4	Enter the ratio of allowable stress over yield stress for inventory rating or design for reinforcing steel for concrete girders or composite slab.	
Concrete Default = 0.4	Enter the ratio of allowable stress over 28-day compression stress for inventory rating or design for concrete for reinforced concrete girders or composite slab.	
Structural Steel Default = 0.55	Enter the ratio of allowable stress over yield stress of structural steel for inventory rating or design for steel girders.	
Timber Default = 1.0	Enter the ratio of allowable stress over design stress for inventory rating of timber girders.	
Stirrups Default = 0.5	Enter the ratio of allowable stress over yield stress for inventory rating or design for reinforcing steel to be used as stirrups in reinforced concrete girders.	
Bearing Stiffeners Default = 0.8	Enter the ratio of allowable stress over yield stress of structural steel used for end bearing on bearing stiffeners for inventory rating or design of steel girders.	
(Continued)		

COMMAND PARAMETERS (Cont.)	
	Ultimate Strength Analysis - For Non-Prestressed Reinforced Concrete Girders use the following 6 parameters. For Prestressed Concrete Girders use the following 10 parameters.
γ, Gamma Default = 1.3	Enter the load factor for ultimate strength analysis (see AASHTO 3.22) to be used for inventory rating. See Note 2.
β_D Beta Dead Load Default = 1.0	Enter the coefficient for dead load for ultimate strength analysis (see AASHTO 3.22) to be used for inventory rating. See Note 2.
β_L Beta Live Load Default = 1.67	Enter the coefficient for live load for ultimate strength analysis (see AASHTO 3.22) to be used for inventory rating. See Note 2.
Φ_M Phi Moment Default = 0.9 for reinforced concrete Default = 1.0 for prestressed concrete	Enter the reduction factor for moment capacity for ultimate strength analysis (see AASHTO 8.16.1.2 and 9.14). This reduction factor will be used for inventory, operating, posting, and safe load rating or design. See Note 3.
Φ_V Phi Shear Default = 0.85 for reinforced concrete Default = 0.90 for prestressed concrete	Enter the reduction factor for shear capacity for ultimate strength analysis (see AASHTO 8.16.1.2 and 9.14). This reduction factor will be used for inventory, operating, posting, and safe load rating or design. See Note 3.
Φ_{MN} Phi Moment Non-Prestressed Default = 0.9	Enter the strength reduction factor for moment strength (non-prestressed concrete in a prestressed structure). This reduction factor will be used for inventory, operating, posting, and safe load rating or design. See Note 3.
Concrete Tension Factor Default = 6.0	Enter the factor to be applied to the square root of f ‘c for calculating the allowable stress for concrete tension for inventory rating. See Note 4.
First Concrete Compression Factor Default = 0.6	Enter the factor to be applied to f ‘c for calculating the allowable stress for concrete compression for inventory rating. See Note 4.
Second Concrete Compression Factor Default = 0.4	Enter the factor to be applied to f ‘c for calculating the allowable stress for concrete compression for inventory rating. See Note 4.
Non-Prestressed Concrete Compression Factor Default = 0.4	Enter the factor to be applied to f ‘c for calculating the allowable stress for concrete compression for inventory rating (service load check) for the non-prestressed concrete for composite prestressed girders. See AASHTO Standard Specifications, Article 8.15.2.1.1 and Note 4.

EXAMPLE

For the working stress rating of a steel girder at inventory level, the INVENTORY command could be coded as follows:

INVENTORY , , 0.50, , , 0.75

The load capacity would be calculated based on 0.5 times yield stress for Flexure and Shear and 0.75 times yield stress for bearing stiffeners in bearing.

FIGURES

NOTES

1. In previous versions of BRASS-GIRDER, this command may have been used in lieu of the LOAD-LEVEL-1 command to define Load Level 1 for steel ultimate strength analysis. In this case, the program is backwards compatible so existing data sets will still run using the INVENTORY command. If the user accepted the defaults in the INVENTORY command, they will be the same defaults as the LOAD-LEVEL-1 command.

2. In accordance with the AASHTO Manual for Condition Evaluation of Bridges, Article 6.5.3, and Standard Specifications for Highway Bridges, Article 3.22, BRASS sets A1 = $\gamma * \beta_D$ and A2 = $\gamma * \beta_L$.

3. In previous versions of BRASS-GIRDER, the user was allowed to input values for Phi in the INVENTORY, OPERATING, POSTING, and SAFE-LOAD commands. Since BRASS only uses the Phi factors input in the INVENTORY command, these three parameters have been removed from the other commands. If archived BRASS-GIRDER data sets contain these three parameters in the OPERATING, POSTING, and SAFE-LOAD commands, the program will no longer read these commands.

4. See Section 6.6.3.3 of the AASHTO Manual for Condition Evaluation of Bridges, Second Edition, Interim 1996.

1000	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	OPERATING	OPG
PURPOSE	This command controls the stress levels or load factors for determining the operating rating or design of a girder. This command is required for an operating rating. Select the parameters for Working Stress or Ultimate Strength as applicable. For steel ultimate strength analysis, use the LOAD-LEVEL-1 through LOAD-LEVEL-4 commands. **IMPORTANT:** See Note 1	
6 OR 3 COMMAND PARAMETERS		
	Working Stress Analysis - For Steel Girders and Non-Prestressed Reinforced Concrete Girders, use the following 6 parameters.	
Rebar Default = 0.6	Enter the ratio of allowable stress over yield stress for operating rating for reinforcing steel for concrete girders or composite slab.	
Concrete Default = 0.55	Enter the ratio of allowable stress over 28-day compression stress for operating rating for concrete for reinforced concrete girders or composite slab.	
Structural Steel Default = 0.75	Enter the ratio of allowable stress over yield stress of structural steel for operating rating for steel girders.	
Timber Default = 1.33	Enter the ratio of allowable stress over design stress for operating rating of timber girders.	
Stirrups Default = 0.75	Enter the ratio of allowable stress over yield stress for operating rating for reinforcing steel to be used as stirrups in reinforced concrete girders.	
Bearing Stiffeners Default = 0.9	Enter the ratio of allowable stress over yield stress of structural steel used for end bearing on bearing stiffeners for operating rating of steel girders.	
	Ultimate Strength Analysis - For Non-Prestressed Reinforced Concrete or Prestressed Concrete Girders use the following 3 parameters.	
γ, Gamma Default = 1.3	Enter the load factor for ultimate strength analysis (see AASHTO 3.22) for operating rating. See Note 2.	
B_D Beta Dead Load Default = 1.0	Enter the coefficient for dead load for ultimate strength analysis (see AASHTO 3.22) for operating rating. See Note 2.	
β_L Beta Live Load Default = 1.0	Enter the coefficient for live load for ultimate strength analysis (see AASHTO 3.22) for operating rating. See Note 2.	

EXAMPLE

For the working stress rating of a steel girder at operating level, the OPERATING command could be coded as follows:

OPERATING , , 0.70, , , 0.85

The load capacity would be calculated based on 0.70 times yield stress for flexure and shear and 0.85 times yield stress for bearing stiffeners in bearing.

NOTES

1. In previous versions of BRASS-GIRDER, this command may have been used in lieu of the LOAD-LEVEL-2 command to define Load Level 2 for steel ultimate strength analysis. In this case, the program is backwards compatible so existing data sets will still run using the OPERATING command. If the user accepted the defaults in the OPERATING command, they will be the same defaults as the LOAD-LEVEL-2 command.

2. In accordance with the AASHTO Manual for Condition Evaluation of Bridges, Article 6.5.3, and Standard Specifications for Highway Bridges, Article 3.22, BRASS sets A1 = $\gamma * \beta_D$ and A2 = $\gamma * \beta_L$.

1010	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	POSTING	PST
PURPOSE	This command controls the stress levels or load factors for determining the posting rating of a girder. This command is required for a posting rating. Select the parameters for Working Stress or Ultimate Strength as applicable. For steel ultimate strength analysis, use the LOAD-LEVEL-1 through LOAD-LEVEL-4 commands. **IMPORTANT:** See Note 1.	
6 OR 3 COMMAND PARAMETERS		
	Working Stress Analysis - For Steel Girders and Non-Prestressed Reinforced Concrete Girders, use the following 6 parameters.	
Rebar	Enter the ratio of allowable stress over yield stress for posting rating for reinforcing steel for concrete girders or composite slab.	
Concrete	Enter the ratio of allowable stress over 28-day compression stress for posting rating for concrete for reinforced concrete girders or composite slab.	
Structural Steel	Enter the ratio of allowable stress over yield stress for structural steel for posting rating for steel girders.	
Timber	Enter the ratio of allowable stress over design stress for posting rating of timber girders.	
Stirrups	Enter the ratio of allowable stress over yield stress for posting rating for reinforcing steel to be used as stirrups in reinforced concrete girders. See Note 2.	
Bearing Stiffeners	Enter the ratio of allowable stress over yield stress of structural steel used for end bearing on bearing stiffeners for posting rating of steel girders.	
	Ultimate Strength Analysis - For Non-Prestressed Reinforced Concrete or Prestressed Concrete Girders use the following 3 parameters.	
γ, Gamma	Enter the load factor for ultimate strength analysis (see AASHTO 3.22) for posting rating. See Note 3.	
β_D Beta Dead Load	Enter the coefficient for dead load for ultimate strength analysis (see AASHTO 3.22) for posting rating. See Note 3.	
β_L Beta Live Load	Enter the coefficient for live load for ultimate strength analysis (see AASHTO 3.22) for posting rating. See Note 3.	

EXAMPLE

1. For the working stress rating of a steel girder at posting level, the POSTING command could be coded as follows:

POSTING , , 0.50, , , 0.75

The load capacity would be calculated based on 0.5 times yield stress for flexure and shear and 0.75 times yield stress for bearing stiffeners in bearing.

2. For the working stress rating of a reinforced concrete girder at posting level, if the user inputs a stirrup allowable strength of 0.75 in the OPERATING command, Parameter 5, and he wants the posting rating to be the same as the operating rating, the user would enter 0.75 in the POSTING command, Parameter 5. The shear strength for posting would then be the shear strength for operating times 0.75/0.75.

3. For the working stress rating of a reinforced concrete girder at posting level, if the user wants the posting rating to be 10% below the operating rating shear capacity, he would input 90% of 0.75 = 0.675 for the allowable stirrup stress for posting.

NOTES

1. In previous versions of BRASS-GIRDER, this command may have been used in lieu of the LOAD-LEVEL-3 command to define Load Level 3 for steel ultimate strength analysis. In this case, the program is backwards compatible so existing data sets will still run using the POSTING command. If the user accepted the defaults in the POSTING command, they will be the same defaults as the LOAD-LEVEL-3 command.

2. The posting shear strength rating of a reinforced concrete girder is based on the total shear strength of the section for operating rating times the ratio of Parameter 5, POSTING command, divided by Parameter 5, OPERATING command. Basically, the posting shear rating is based on the ratio, posting/operating, of the allowable operating stirrup stress.

3. In accordance with the AASHTO Manual for Condition Evaluation of Bridges, Article 6.5.3, and Standard Specifications for Highway Bridges, Article 3.22, BRASS sets A1 = $\gamma * \beta_D$ and A2 = $\gamma * \beta_L$.

1020	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	SAFE-LOAD	SLD
PURPOSE	This command controls the stress levels or load factors for determining the safe load capacity rating of a girder. This command is required for a safe load capacity rating. Select the parameters for Working Stress or Ultimate Strength as applicable. For steel ultimate strength analysis, use the LOAD-LEVEL-1 through LOAD-LEVEL-4 commands. **IMPORTANT:** See Note 1.	
6 OR 3 COMMAND PARAMETERS		
	Working Stress Analysis - For Steel Girders and Non-Prestressed Reinforced Concrete Girders, use the following 6 parameters.	
Rebar	Enter the ratio of allowable stress over yield stress for safe load capacity rating for reinforcing steel for concrete girders or composite slab.	
Concrete	Enter the ratio of allowable stress over 28-day compression stress for safe load capacity rating for concrete for reinforced concrete girders or composite slab.	
Structural Steel	Enter the ratio of allowable stress over yield stress for structural steel for safe load capacity rating for steel girders.	
Timber	Enter the ratio of allowable stress over design stress for safe load capacity rating of timber girders.	
Stirrups	Enter the ratio of allowable stress over yield stress for safe load capacity rating for reinforcing steel to be used as stirrups in reinforced concrete girders. See Note 2.	
Bearing Stiffeners	Enter the ratio of allowable stress over yield stress of structural steel used for end bearing on bearing stiffeners for safe load capacity rating of steel girders.	
	Ultimate Strength Analysis - For Non-Prestressed Reinforced Concrete or Prestressed Concrete Girders use the following 3 parameters.	
γ, Gamma	Enter the load factor for ultimate strength analysis (see AASHTO 3.22) for safe load capacity rating. See Note 3.	
β_D Beta Dead Load	Enter the coefficient for dead load for ultimate strength analysis (see AASHTO 3.22) for safe load capacity rating. See Note 3.	
β_L Beta Live Load	Enter the coefficient for live load for ultimate strength analysis (see AASHTO 3.22) for safe load capacity rating. See Note 3.	

EXAMPLE

1. For the working stress rating of a steel girder at safe load capacity level, the SAFE-LOAD command could be coded as follows:

SAFE-LOAD , , 0.50, , , 0.75

The load capacity would be calculated based on 0.5 times yield stress for flexure and shear and 0.75 times yield stress for bearing stiffeners in bearing.

2. For the working stress rating of a reinforced concrete girder at safe load level, if the user inputs a stirrup allowable strength of 0.75 in the OPERATING command, Parameter 5, and he wants the safe load rating to be the same as the operating rating, the user would enter 0.75 in the SAFE-LOAD command, Parameter 5. The shear strength for safe load would then be the shear strength for operating times 0.75/0.75.

3. For the working stress rating of a reinforced concrete girder at safe load level, if the user wants the safe load rating to be 10% below the operating rating shear capacity, he would input 90% of 0.75 = 0.675 for the allowable stirrup stress for safe load.

NOTES

1. In previous versions of BRASS-GIRDER, this command may have been used in lieu of the LOAD-LEVEL-4 command to define Load Level 4 for steel ultimate strength analysis. In this case, the program is backwards compatible so existing data sets will still run using the SAFE-LOAD command. If the user accepted the defaults in the SAFE-LOAD command, they will be the same defaults as the LOAD-LEVEL-4 command.

2. The safe load shear strength rating of a reinforced concrete girder is based on the total shear strength of the section for operating rating times the ratio of Parameter 5, SAFE-LOAD command, divided by Parameter 5, OPERATING command. Basically, the safe load shear rating is based on the ratio, safe load/operating, of the allowable operating stirrup stress.

3. In accordance with the AASHTO Manual for Condition Evaluation of Bridges, Article 6.5.3, and Standard Specifications for Highway Bridges, Article 3.22, BRASS sets A1 = $\gamma * \beta_D$ and A2 = $\gamma * \beta_L$.

1021	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	LOAD-LEVEL-1	LL1
PURPOSE	This command controls the load factors, coefficients and reduction factors for Load Level 1 for steel ultimate strength analysis. This command is required for design or inventory rating unless the defaults are correct.	

6 COMMAND PARAMETERS

γ, Gamma Default = 1.3	Enter the load factor for steel ultimate strength analysis to be used for load level 1. See Notes 1 and 3.
β_D Beta Dead Load Default = 1.0	Enter the coefficient for dead load for steel ultimate strength analysis to be used for load level 1. See Notes 1 and 3.
β_L Beta Live Load Default = 1.67	Enter the coefficient for live load for steel ultimate strength analysis to be used for load level 1. See Notes 1 and 3.
Φ_M Phi Moment Default = 1.0	Enter the reduction factor for moment capacity for steel ultimate strength analysis to be used for load level 1 design. See Notes.
Φ_V Phi Shear Default = 1.0	Enter the reduction factor for shear capacity for steel ultimate strength analysis to be used for load level 1 design. See Notes.
Φ_B Phi Bearing Default = 1.0	Enter the reduction factor for bearing stiffener resistance for steel ultimate strength analysis to be used for load level 1 design. See Notes.

EXAMPLE

For the ultimate strength (LFD) rating of a steel girder, the LOAD-LEVEL-1 command could be coded as follows:

LOAD-LEVEL-1 1.3, 1.0, 1.67, 1.0, 1.0, 1.0

NOTES

1. The ultimate strength (LFD) ratings for steel are determined by the table below. This table is generated at the end of the rating results as output for user clarity.

Load Level	Command to be Used	Load Combination	Strength	Serviceability Steel/Reinf.	Serviceability Fatigue
1	LOAD-LEVEL-1	1.3(D + 1.67L)	Inv	N/A	N/A
2	LOAD-LEVEL-2	D + 1.67L	N/A	Inv	N/A
3	LOAD-LEVEL-3	1.3(D + L)	Oper	N/A	N/A
4	LOAD-LEVEL-4	D + L	N/A	Oper	Inv

The ultimate strength rating for inventory and operating level use all LOAD-LEVEL-1, LOAD-LEVEL-2, LOAD-LEVEL-3, and LOAD-LEVEL-4 commands, which are required to define the table above. These commands are used to define load levels and not a rating level. Currently, steel ultimate strength posting and safe load ratings are not available for steel girders. *

2. These fields allow the user to decrease strength of a section. Note that the phi factor is applied to all calculations associated with a particular action. For example, a phi = 0.9 for moment is used in all rating calculations involving moment; i.e., all rating factors except shear and bearing.

* Load level 1 is automatically generated and levels 2 - 4 are generated only if their respective commands are entered.

3. In accordance with the AASHTO Manual for Condition Evaluation of Bridges, Article 6.5.3, and Standard Specifications for Highway Bridges, Article 3.22, BRASS sets A1 = $\gamma * \beta_D$ and A2 = $\gamma * \beta_L$.

1022	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	LOAD-LEVEL-2	LL2
PURPOSE	This command controls the load factors, coefficients and reduction factors for Load Level 2 for steel ultimate strength analysis. This command is required for design or inventory rating unless the defaults are correct.	

6 COMMAND PARAMETERS

γ, Gamma Default = 1.0	Enter the load factor for steel ultimate strength analysis to be used for load level 2. See Notes 1 and 3.
β_D Beta Dead Load Default = 1.0	Enter the coefficient for dead load for steel ultimate strength analysis to be used for load level 2. See Notes 1 and 3.
β_L Beta Live Load Default = 1.67	Enter the coefficient for live load for steel ultimate strength analysis to be used for load level 2 . See Notes 1 and 3.
Φ_M Phi Moment Default = 1.0	Enter the reduction factor for moment capacity for steel ultimate strength analysis to be used for load level 2 design. See Notes.
Φ_V Phi Shear Default = 1.0	Enter the reduction factor for shear capacity for steel ultimate strength analysis to be used for load level 2 design. See Notes.
Φ_B Phi Bearing Default = 1.0	Enter the reduction factor for bearing stiffener resistance for steel ultimate strength analysis to be used for load level 2 design. See Notes.

EXAMPLE

For the ultimate strength (LFD) rating of a steel girder, the LOAD-LEVEL-2 command could be coded as follows:

LOAD-LEVEL-2 1.0, 1.0, 1.67, 1.0, 1.0, 1.0

NOTES

1. The ultimate strength (LFD) ratings for steel are determined by the table below. This table is generated at the end of the rating results as output for user clarity.

Load Level	Command to be Used	Load Combination	Strength	Serviceability Steel/Reinf.	Serviceability Fatigue
1	LOAD-LEVEL-1	1.3(D + 1.67L)	Inv	N/A	N/A
2	LOAD-LEVEL-2	D + 1.67L	N/A	Inv	N/A
3	LOAD-LEVEL-3	1.3(D + L)	Oper	N/A	N/A
4	LOAD-LEVEL-4	D + L	N/A	Oper	Inv

The ultimate strength rating for inventory and operating level use all LOAD-LEVEL-1, LOAD-LEVEL-2, LOAD-LEVEL-3, and LOAD-LEVEL-4 commands, which are required to define the table above. These commands are used to define load levels and not a rating level. Currently, steel ultimate strength posting and safe load ratings are not available for steel girders. *

2. These fields allow the user to decrease strength of a section. Note that the phi factor is applied to all calculations associated with a particular action. For example, a phi = 0.9 for moment is used in all rating calculations involving moment; i.e., all rating factors except shear and bearing.

* Load level 1 is automatically generated and levels 2 - 4 are generated only if their respective commands are entered.

3. In accordance with the AASHTO Manual for Condition Evaluation of Bridges, Article 6.5.3, and Standard Specifications for Highway Bridges, Article 3.22, BRASS sets A1 = $\gamma * \beta_D$ and A2 = $\gamma * \beta_L$.

1023	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	LOAD-LEVEL-3	LL3
PURPOSE	This command controls the load factors, coefficients and reduction factors for Load Level 3 for steel ultimate strength analysis. This command is required for operating rating unless the defaults are correct.	

6 COMMAND PARAMETERS

γ, Gamma Default = 1.3	Enter the load factor for steel ultimate strength analysis to be used for load level 3. See Notes 1 and 3.
β_D Beta Dead Load Default = 1.0	Enter the coefficient for dead load for steel ultimate strength analysis to be used for load level 3. See Notes 1 and 3.
β_L Beta Live Load Default = 1.0	Enter the coefficient for live load for steel ultimate strength analysis to be used for load level 3. See Notes 1 and 3.
Φ_M Phi Moment Default = 1.0	Enter the reduction factor for moment capacity for steel ultimate strength analysis to be used for load level 3 design. See Notes.
Φ_V Phi Shear Default = 1.0	Enter the reduction factor for shear capacity for steel ultimate strength analysis to be used for load level 3 design. See Notes.
Φ_B Phi Bearing Default = 1.0	Enter the reduction factor for bearing stiffener resistance for steel ultimate strength analysis to be used for load level 3 design. See Notes.

EXAMPLE

For the ultimate strength (LFD) rating of a steel girder, the LOAD-LEVEL-3 command could be coded as follows:

LOAD-LEVEL-3 1.3, 1.0, 1.0, 1.0, 1.0, 1.0

NOTES

1. The ultimate strength (LFD) ratings for steel are determined by the table below. This table is generated at the end of the rating results as output for user clarity.

Load Level	Command to be Used	Load Combination	Strength	Serviceability Steel/Reinf.	Serviceability Fatigue
1	LOAD-LEVEL-1	1.3(D + 1.67L)	Inv	N/A	N/A
2	LOAD-LEVEL-2	D + 1.67L	N/A	Inv	N/A
3	LOAD-LEVEL-3	1.3(D + L)	Oper	N/A	N/A
4	LOAD-LEVEL-4	D + L	N/A	Oper	Inv

The ultimate strength rating for inventory and operating level use all LOAD-LEVEL-1, LOAD-LEVEL-2, LOAD-LEVEL-3, and LOAD-LEVEL-4 commands, which are required to define the table above. These commands are used to define load levels and not a rating level. Currently, steel ultimate strength posting and safe load ratings are not available for steel girders. *

2. These fields allow the user to decrease strength of a section. Note that the phi factor is applied to all calculations associated with a particular action. For example, a phi = 0.9 for moment is used in all rating calculations involving moment; i.e., all rating factors except shear and bearing.

* Load level 1 is automatically generated and levels 2 - 4 are generated only if their respective commands are entered.

3. In accordance with the AASHTO Manual for Condition Evaluation of Bridges, Article 6.5.3, and Standard Specifications for Highway Bridges, Article 3.22, BRASS sets A1 = $\gamma * \beta_D$ and A2 = $\gamma * \beta_L$.

1024	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	LOAD-LEVEL-4	LL4
PURPOSE	This command controls the load factors, coefficients and reduction factors for Load Level 4 for steel ultimate strength analysis. This command is required for inventory and operating rating unless the defaults are correct.	

6 COMMAND PARAMETERS

γ, Gamma Default = 1.0	Enter the load factor for steel ultimate strength analysis to be used for load level 4. See Notes 1 and 3.
β_D Beta Dead Load Default = 1.0	Enter the coefficient for dead load for steel ultimate strength analysis to be used for load level 4. See Notes 1 and 3.
β_L Beta Live Load Default = 1.0	Enter the coefficient for live load for steel ultimate strength analysis to be used for load level 4. See Notes 1 and 3.
Φ_M Phi Moment Default = 1.0	Enter the reduction factor for moment capacity for steel ultimate strength analysis to be used for load level 4 design. See Notes.
Φ_V Phi Shear Default = 1.0	Enter the reduction factor for shear capacity for steel ultimate strength analysis to be used for load level 4 design. See Notes.
Φ_B Phi Bearing Default = 1.0	Enter the reduction factor for bearing stiffener resistance for steel ultimate strength analysis to be used for load level 4 design. See Notes.

EXAMPLE

For the ultimate strength (LFD) rating of a steel girder, the LOAD-LEVEL-4 command could be coded as follows:

LOAD-LEVEL-4 1.0, 1.0, 1.0, 1.0, 1.0, 1.0

NOTES

1. The ultimate strength (LFD) ratings for steel are determined by the table below. This table is generated at the end of the rating results as output for user clarity.

Load Level	Command to be Used	Load Combination	Strength	Serviceability Steel/Reinf.	Serviceability Fatigue
1	LOAD-LEVEL-1	1.3(D + 1.67L)	Inv	N/A	N/A
2	LOAD-LEVEL-2	D + 1.67L	N/A	Inv	N/A
3	LOAD-LEVEL-3	1.3(D + L)	Oper	N/A	N/A
4	LOAD-LEVEL-4	D + L	N/A	Oper	Inv

The ultimate strength rating for inventory and operating level use all LOAD-LEVEL-1, LOAD-LEVEL-2, LOAD-LEVEL-3, and LOAD-LEVEL-4 commands, which are required to define the table above. These commands are used to define load levels and not a rating level. Currently, steel ultimate strength posting and safe load ratings are not available for steel girders. *

2. These fields allow the user to decrease strength of a section. Note that the phi factor is applied to all calculations associated with a particular action. For example, a phi = 0.9 for moment is used in all rating calculations involving moment; i.e., all rating factors except shear and bearing.

* Load level 1 is automatically generated and levels 2 - 4 are generated only if their respective commands are entered.

3. In accordance with the AASHTO Manual for Condition Evaluation of Bridges, Article 6.5.3, and Standard Specifications for Highway Bridges, Article 3.22, BRASS sets A1 = $\gamma * \beta_D$ and A2 = $\gamma * \beta_L$.

1025	BRASS-GIRDER™	COMMAND DESCRIPTION	
COMMAND NAME		**POINT-OF-INTEREST**	**POI**
PURPOSE		Use to designate points of interest when option 3, 4 or 5 is selected for parameter six of the ANALYSIS command. This command may be repeated as needed. A total of 212 points of interest may be specified. This command is optional.	
10 COMMAND PARAMETERS			
Point of Interest		Define as 101, 102.5, 302, etc. See Notes.	
Point of Interest		Define as 101, 102.5, 302, etc. See Notes.	
Point of Interest		Define as 101, 102.5, 302, etc. See Notes.	
Point of Interest		Define as 101, 102.5, 302, etc. See Notes.	
Point of Interest		Define as 101, 102.5, 302, etc. See Notes.	
Point of Interest		Define as 101, 102.5, 302, etc. See Notes.	
Point of Interest		Define as 101, 102.5, 302, etc. See Notes.	
Point of Interest		Define as 101, 102.5, 302, etc. See Notes.	
Point of Interest		Define as 101, 102.5, 302, etc. See Notes.	
Point of Interest		Define as 101, 102.5, 302, etc. See Notes.	

EXAMPLE

To generate analysis for points of interest 104, 200, and 205, and when the sixth parameter of the ANALYSIS command is coded 5, code as follows:

```
POI     104,  200,  205
```

FIGURES

NOTES

IMPORTANT: Specified points of interest must be within .001 times the span length of a structural analysis node point. This is 1/100th of tenth points. For example, if a node point is at 46.25' from the left end of a 100' span, the 1/10 point location is 104.625 (the 4.625 tenth point). The point of interest input must be between 104.615 and the 104.635 (i.e. 104.62 will work). Node points are automatically generated at all 1/10 points of all spans and at all cross section or web depth change locations. Additional node points may be entered by using the HINGE command and the TRANSFER command (prestress).

1026	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	INTERMEDIATE-OUTPUT	INO
PURPOSE	Use to designate points of interest for which intermediate (detailed) output for the AASHTO Specification checks is desired. This command may be repeated as needed. A total of 212 points of interest may be specified. However, the amount of output generated for each point is significant. This command is optional.	

10 COMMAND PARAMETERS	
Point of Interest	Define as 101, 102.5, 302, etc. See Notes.
Point of Interest	Define as 101, 102.5, 302, etc. See Notes.
Point of Interest	Define as 101, 102.5, 302, etc. See Notes.
Point of Interest	Define as 101, 102.5, 302, etc. See Notes.
Point of Interest	Define as 101, 102.5, 302, etc. See Notes.
Point of Interest	Define as 101, 102.5, 302, etc. See Notes.
Point of Interest	Define as 101, 102.5, 302, etc. See Notes.
Point of Interest	Define as 101, 102.5, 302, etc. See Notes.
Point of Interest	Define as 101, 102.5, 302, etc. See Notes.
Point of Interest	Define as 101, 102.5, 302, etc. See Notes.

EXAMPLE

To generate intermediate output at points of interest 104, 200, and 205, code as follows:

```
INO     104,  200,  205
```

FIGURES

NOTES

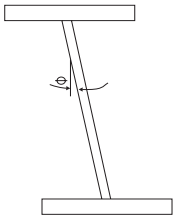
IMPORTANT: Specified points of interest for intermediate output must have been automatically generated or input using the POINT-OF-INTEREST command.

1030	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	STEEL-1	SL1
PURPOSE	This is the first in a series of commands to describe factors affecting the design or rating analysis of a particular point along the girder. It is required when designing certain aspects of a steel girder or rating a steel girder for load capacity. This series of commands is required for each of up to 212 analysis points allowed.	

10 COMMAND PARAMETERS

Analysis Point	Enter the span point at which an analysis of the girder section is desired. Use the following format: 104 = 4/10 of distance from left end of span 1 along span 1. *106.5 = 65/100 of distance from left end of span 1 along span 1. 110 = 10/10 of distance from left end of span 1 along span 1. Basically this is the right end of span 1. 200 = 0/10 of distance from left end of span 2 along span 2. Basically this is the left end of span 2. *Note: Only 1/10 points may be analyzed on a span unless there is a node point at the desired location created by a cross-section change or a special analysis point from the HINGE command.
Section Type (Continued)	Enter one of the following codes to describe the type of steel girder at this analysis point (see Notes 1, 2, and 3): 2 = Non-composite rolled or welded steel girder. 3 = Riveted. See Note, STEEL-2 command. 4 = Composite steel & concrete section where dead load moment is positive (tension in bottom of section). See Note 1. 5 = Composite steel and concrete section where the dead load moment is negative (tension in top of the section). See Note 1. 41 = The composite steel girder cross section at this point may be compact and the girder cross sections at the adjacent pier(s) are compact or moment released (i.e. hinge or pin connected) and you desire the program to check AASHTO Equation 10-129b and 10-129c. If you want the section at this analysis point to be analyzed as non-compact, code 4. See Note 2.

COMMAND PARAMETERS (Cont.)	
Web Angle Default = 0.0	Enter the angle θ in degrees if the web is not vertical. See Note 3. 
Transverse Stiffener Spacing Inches	If this is a rating analysis of an existing girder or a splice design is desired at the analysis point being considered, enter the longitudinal spacing in inches of the transverse stiffeners in the area of the analysis point and to be used in determining the load carrying capacity of the section. If zero or a blank is input, it is assumed that no transverse stiffeners exist. For a splice design, the shear strength of the girder used in the design of the splice will be determined from this input. See Note 3.
Transverse Stiffener Width	If a rating is desired at the analysis point being considered, enter the width of one intermediate transverse stiffener in inches. See Note 3. If a transverse stiffener design is desired, follow the instructions in Note 3 on Page 14.4.
Transverse Stiffener Thickness	If a rating is desired at the analysis point being considered, enter the thickness of one intermediate transverse stiffener in inches. See Note 3.
f_y Transverse Stiffener Material Default = 36 ksi	Enter the yield stress of the steel used for intermediate transverse stiffeners. See Note 3.
IBS Default = 2.4	Enter the intermediate transverse stiffener type factor. See Note 3. 1.0 = Stiffener Pairs 1.8 = Single Angles 2.4 = Single Plates If 1.0 is coded, the program will calculate the properties based on two stiffeners. AASHTO (10-31a), (10-110)
Tension Field Action Flag Default = 0	Used in Working Stress Design method only. Leave blank for Ultimate Strength Design method. Flag = 0 Ignore combined shear and bending. Eliminates tension field action from allowable shear equation (AASHTO E_Q 10.26). Flag = 1 Account for combined shear and bending - if necessary. Includes tension filed action in the allowable shear equation (AASHTO E_Q 10.29).
Intermediate Output Default = 0 (not output)	Enter a 1 if a detailed output report is desired for most of the AASHTO Specification checks. This feature outputs intermediate values which aid in hand computations. Rating factor calculations for each load level and truck are also given. Load Factor method only. Enter a 0 to suppress this report.

EXAMPLE

For the rating of a welded plate girder transversely stiffened by 1/2" x 4" intermediate transverse stiffeners (A36 single plates) at 18 inch intervals near the 4/10 span point of span 1, the STEEL-1 command would be coded as follows:

```
STEEL-1  104,  ,          ,       18,    4,       0.5,   36,      2.4
```

NOTES

1. To determine whether to use option 4 or 5 for the type of steel girder, refer to the typical cross section defined at this point. If the cross section includes the composite slab in the calculation of the moment of inertia of the section, enter 4 (see Note 2 below). If negative moment occurs at this point, the concrete slab will be in tension and the moment of inertia will be in error. BRASS will print a message explaining the condition and action taken.

If the cross section is composite and does include slab reinforcement, enter 5 (see Note 2 below). If positive moment occurs, the concrete slab will be in compression and the moment of inertia will be in error. BRASS will print a message explaining the condition and action taken.

Please refer to AASHTO 10.50.1.1.2

2. The following does not apply to hybrid girder sections:

Code 41 if the girder cross section at this point may be compact and the girder cross sections at the adjacent pier(s) are compact or moment relieved (i.e. hinge or pin connected) and you desire the program to check AASHTO Equation 10-129b and 10-129c. If you want the section at this analysis point to be analyzed as non-compact, code 4. Suggestion: BRASS may be run with the pier points coded (the 200, 300, 400, points, etc.) with the intermediate output turned on to see if the sections at those points are compact.

Also note that compactness is a function of loading and load factors, hence compactness is not always simple to determine. If BRASS is run to establish compactness, the engineer should revise all (or the appropriate) load cases and levels by reviewing the intermediate output for the pier sections.

NOTES

3. If you have used the STIFF-TRAN-GROUP, STEEL-GIRDER-CONTROL, and/or STIF-TRAN-SCHEDULE commands, this parameter (or any non-blank entry in this parameter) may be used to override the input from the commands listed above for the analysis point defined in parameter 1 of the STEEL-1 command. The default values for this command will not be activated for this override feature.

1040	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	STEEL-2	SL2
PURPOSE	This is the second in a series of commands to describe factors affecting the design or rating analysis of a particular point along the girder. It is required when designing certain aspects of a steel girder or rating a steel girder for load capacity. This series of commands is required for each of up to 212 analysis points allowed.	

8 COMMAND PARAMETERS

Longitudinal Stiffeners Default = 0	If the welded plate girder section to be rated for load capacity has longitudinal stiffeners at this analysis point, enter 1. See Note 2. For other types of sections or for design analysis, leave blank.
Unsupported Length of Compression Flange Default = 0	Used in Working Stress Design method only. Leave blank for Ultimate Strength Design method. (See STEEL-4 command for Ultimate Strength Design method.) Enter the unsupported length, in feet, of the compression flange at this analysis point. In a positive moment region, only stage 1 is considered. The unsupported length is assumed to be zero for stage 2 & 3 (composite slab). For stage 2 or stage 3, enter the unsupported length, in feet, in the negative moment region. For example, at an interior support where there is negative moment, if the analysis point is 200, the distance to enter would be the distance in span 2 along the bottom flange to the first lateral bracing or to the inflection point, whichever is shorter.
Longitudinal Stiffener Location Default = Web Depth/5	Enter the distance, in inches, from the center of the longitudinal stiffener to the face of the flange denoted by the next parameter. See Note 3.
Longitudinal Stiffener Reference	Enter 'T' if the distance to the longitudinal stiffener is measured from the face of the top flange. Enter 'B' if the distance is measured from the face of the bottom flange. See Figure and Note 3.
I_{NET} (Continued)	If this is a non-composite riveted section, enter the net moment of inertia in inches^4 of the cross section at this analysis point. This moment of inertia will be used by BRASS for calculation of stresses for all stages. $(f = \frac{Mc}{I_{NET}})$ This parameter is optional and is not valid for composite sections or load factor analysis. See Note 1.

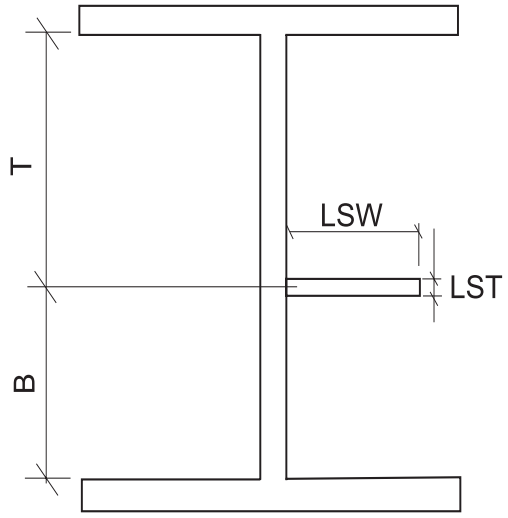
COMMAND PARAMETERS (con't)	
$D_{CENTROID}$	If this is a riveted section, enter the distance in inches from the bottom of the bottom flange to the centroid of the net section. This would be used only if this distance is different than it is for the gross section. This parameter is optional and is not valid for load factor analysis. See Note 1.
Longitudinal Stiffener Width (in), LSW	If a rating has been requested and longitudinal stiffeners exist, enter the longitudinal stiffener width. See Figure and Notes 2 and 3. If a longitudinal stiffener design is desired, follow the instructions in Note 3 on Page 14.4. Note: Longitudinal stiffeners are assumed to be made out of the same material as the transverse stiffeners.
Longitudinal Stiffener Thickness (in), LST	If a rating has been requested and longitudinal stiffeners exist, enter the longitudinal stiffener thickness. See Figure and Notes 2 and 3.

EXAMPLE

For the rating at the 2.0 of a welded plate girder bridge longitudinally stiffened in the area of the supports and lateral bracing 10 feet from the support.

STEEL-2 1, 10, , , , , 4, .3125

FIGURES



NOTES

1. At this time, BRASS-GIRDER™ does not accommodate built up steel sections comprised of angles, plates and rivets or bolts when the strength design (load factor) analysis method is selected. See input parameter #2 of the DESIGN command. Also, BRASS-GIRDER™ cannot accomodate composite sections. No reductions or adjustments are made by BRASS-GIRDER™ to allow for reduced section due to holes. Data entered in parameters 5 or 6 of the STEEL-2 command or parameters 1, 2, or 5 of the STEEL-3 command are ignored when load factor analysis is selected. If desired, the user may calculate an equivalent smaller section to account for the rivet holes and enter it as a welded or rolled beam (composite or non-composite).

2. Due to changes in the AASHTO Standard Specifications, these parameters are required when longitudinal stiffeners are input.

NOTES

3. If you have used the STIF-LONG-GROUP command, this parameter (or any non-blank entry in this parameter) may be used to override the input from the commands listed above for the analysis point defined in parameter 1 of the STEEL-1 command. The default values for this command will not be activated for this override feature.

1050	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	STEEL-3	SL3
PURPOSE	This is the third in a series of commands to describe factors affecting the design or rating analysis of a particular point along the girder. It is required for rating riveted steel girders, composite steel and concrete girders, or steel girders with cover plates. This series of commands is required for each of up to 212 analysis points allowed - working stress analysis only. This command is not valid for load factor analysis. See Notes.	

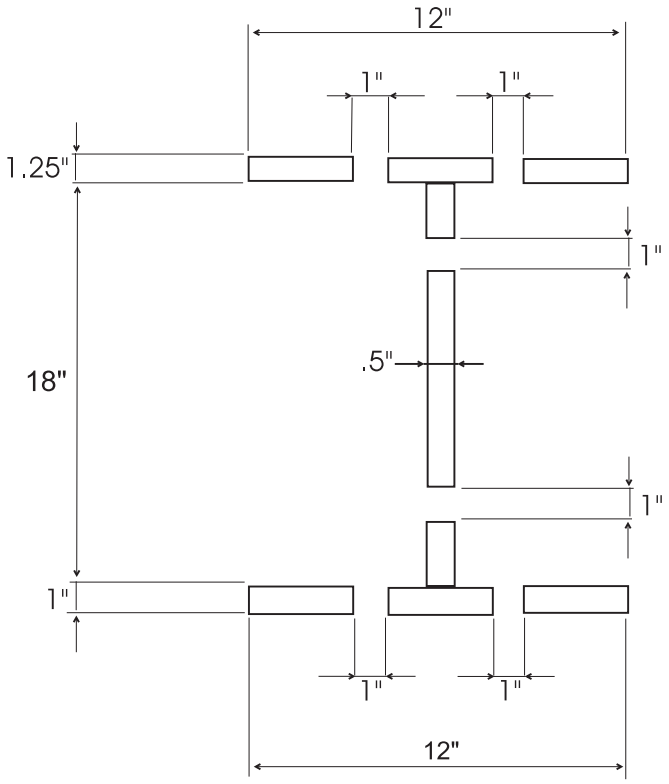
5 COMMAND PARAMETERS	
Net area of web	If this is a riveted section, enter the net area of the web in square inches for vertical shear calculation. This is optional for the rating of a riveted plate girder.
% A_{TOP}	If this is a riveted section enter the percent of the area of the top flange to be used in calculation of the horizontal shear at the top of the web. This is optional for the rating of a riveted plate girder.
Allowable Shear for Top Cover Plate or Composite Flange	If a rating for horizontal shear is desired, and if this is a steel section with a top cover plate or a composite flange, enter the allowable shear in lbs/linear inch of girder length at the junction between the top flange and the cover plate or composite slab. Used for shear flow calculations.
Allowable Shear for Bottom Cover Plate	If a rating for horizontal shear is desired, and if this is a steel section with a bottom cover plate, enter the allowable shear in lbs/linear inch of girder length at the junction between the bottom flange and the cover plate or composite slab. Used for shear flow calculations.
% A_{BOTTOM}	If this is a riveted section, enter the percent of the area of the bottom flange to be used in calculation of the horizontal shear at the bottom of the web. This is optional for the rating of a riveted plate girder.

EXAMPLE

For the riveted section shown below, the STEEL-3 command would be coded as follows:

STEEL-3 8, 12.5, , , 10.0

FIGURES



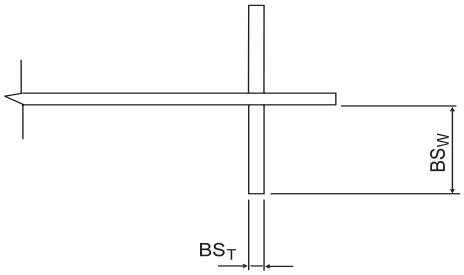
NOTES

At this time, BRASS-GIRDER™ does not accommodate built up steel sections comprised of angles, plates and rivets or bolts when the strength design (load factor) analysis method is selected. See input parameter #2 of the DESIGN command. No reductions or adjustments are made by BRASS-GIRDER™ to allow for reduced section due to holes. Data entered in parameters 5 or 6 of the STEEL-2 command or the STEEL-3 command are ignored when load factor analysis is selected. If desired, the user may calculate an equivalent smaller section to account for the rivet holes and BRASS will treat it as a welded or rolled beam.

1060	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	STEEL-4	SL4
PURPOSE	This is the fourth in a series of commands to describe factors affecting the design or rating analysis of a particular point along the girder. It is required for the design or rating of bearing stiffeners or ultimate strength steel design or rating brace location details. This series of commands is required for each of up to 212 analysis points allowed.	

12 COMMAND PARAMETERS

fy Bearing Stiffener Default = 36 ksi	Enter the yield stress of the steel used for bearing stiffeners in kips/sq. inch. Only required at a span end if bearing stiffener analysis is desired. See Note 5.
Bearing Stiffener Clip Default = 0.75	Code the bearing stiffener clip dimension in inches parallel to the bottom flange. Only required at a span end if bearing stiffener analysis is desired. See Figure and Note 5.
Girder Type Default = 2 Required entry for a rolled beam girder when a bearing stiffener analysis is desired.	Enter the appropriate code below for the type of girder at the point of bearing. 1 = Rolled beam 2 = Welded plate
Bearing Stiffener Thickness	If the analysis point being considered is at a support and a rating of the load carrying capacity of the bearing stiffener is desired, enter the thickness of the bearing stiffener in inches. See BS_T below and Note 5. If a bearing stiffener design is desired, follow the instructions in Note 3 on Page 14.4.
Bearing Stiffener Width (Continued)	If the analysis point being considered is at a support and a rating of the load carrying capacity of the bearing stiffener is desired, enter the width of the bearing stiffener in inches. See BS_W below. BRASS will calculate the load carrying capacity based on two stiffeners of size BS_T by BS_W. See Note 5.  Reference: AASHTO 10.34.6

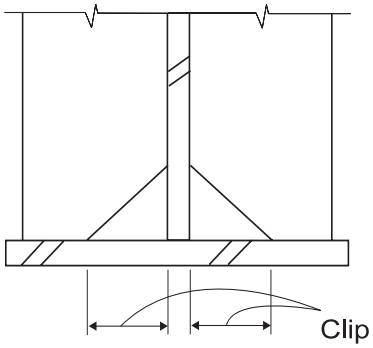
COMMAND PARAMETERS (Cont.)	
Lateral/Support and Bracing Default = 0	Note: This parameter is required for Load Factor (ultimate strength) analysis only and can be used in positive moment regions for staged construction. See Note 1. Code: 0 = There is not a cross frame at this location, the deck does not provide lateral support for the top flange in this area. 1 = There is a cross frame at this location, the deck provides lateral support for the top flange in this area. 2 = There is not a cross frame at this location, the deck provides lateral support for the top flange in this area. Note: In the case of a composite steel and concrete structure, if there are shear connectors at this point, code 1 or 2. BRASS will assume the top flange is laterally unsupported by the deck for stage one loadings, if this is a design run. 3 = There is a cross frame at this location, the deck does not provide lateral support for the top flange in this area.
B_{LEFT} Default = 0	Note: This parameter is required for Load Factor (ultimate strength) analysis only and can be used in positive moment regions for staged construction. See Note 1. Enter the distance, in feet, to the first cross frame to the left of this analysis point. See Notes 2 and 3.
B_{RIGHT} Default = 0	Note: This parameter is required for Load Factor (ultimate strength) analysis only and can be used in positive moment regions for staged construction. See Note 1. Enter the distance, in feet, to the first cross frame to the right of this analysis point. See Notes 2 and 3.
Allowable Fatigue Stress Default = 1 X 10^{10} ksi (The large value for a default allows the user to remove it from rating, if desired).	Enter the allowable fatigue stress in ksi. Ultimate Strength Design/Rating only. See Note 5.
Operating Rating Based on Serviceability Default = 0	Enter 1 if the LFD operating rating check for steel girders for serviceability is to be skipped. See Note 5.
C_b - For Positive Bending Moment Default = Computed Using AASHTO 10.48.4.1	This parameter allows the user to override the calculation of C_b for positive bending moment. See Note 5.
C_b For Negative Bending Moment Default = Computed Using AASHTO 10.48.4.1	This parameter allows the user to override the calculation of C_b for negative bending moment. See Note 5.

EXAMPLE

For the rating of a welded plate structure with 1 inch x 6 inch bearing stiffeners made from A36 steel and 1 inch clips for the fillet weld of web to flange:

STEEL-4 36, 1, 2, 1, 6

FIGURES



NOTES

1. For a load rating, checking AASHTO specifications for a dead load stage(s) of composite girders is not done. If you need stiffener checks in the dead load stage(s), request the design option on the DESIGN command.

2. This makes the assumption that cross frames are vertical X, K or channel type braces that support the top and bottom.

3. BRASS assumes that girders will be braced at the top and bottom at supports (span ends). If the analysis point under consideration is not at a support and if the distance to the cross frame places the cross frame in an adjacent span, BRASS will use the distance to the span end.

4. If the point of support is the top of an integral column and the first cross frame is at the support with the column, code the distance to the cross frame as the distance to the span end, minus 0.1 feet. This is necessary so that BRASS will know whether to use the moment to the left or to the right of the support.

NOTES

5. If you have used the STIF-BEAR-GROUP and/or STEEL-GIRDER-CONTROL commands, this parameter (or any non-blank entry in this parameter) may be used to override the input from the commands listed above for the analysis point defined in parameter 1 of the STEEL-1 command. The default values for this command will not be activated for this override feature.

1065	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	STEEL-5	SL5
PURPOSE	This is the fifth in a series of commands to describe factors affecting the design or rating analysis of a particular point along the girder. This command is required for an ultimate strength design of a steel girder splice. The steel girder splice component of BRASS-GIRDER is current with the AASHTO Standard Specifications with 1997 and 1998 Interims. There were numerous changes for splice analysis in the 1999 Interims and these changes have not been incorporated.	

9 COMMAND PARAMETERS

	IMPORTANT: The INVENTORY, OPERATING, POSTING, and SAFE-LOAD commands must be used when performing an ultimate strength design of a steel girder splice. See Note 1 on page 14.9
Splice Design Indicator Default = N	If a splice design is desired, indicate the girder (left/right) which will control the design. This girder's cross-section properties and yield strength(s) will be used in the splice design. N = No splice design is desired L = Left girder to control splice design R = Right girder to control splice design
Cycles	Enter the code of the number of stress cycles to which the splice is to be subjected. Code — Cycles 1 — 100,000 2 — 500,000 3 — 2,000,000 4 — over 2,000,000
FK	Code the distance, in inches, from centerline of web to the edge of the inner flange splice plates (see Figure).
WK	Code the minimum distance in inches from a flange to the edge of a web splice plate (see Figure).

(Continued)

<table>
<tr><th colspan="2">COMMAND PARAMETERS (Cont.)</th></tr>
<tr><td>MEM</td><td>Code the number representing the member type.

1 = Welded plate w/4" X 4" bolt spacing
2 = Rolled beam w/3" X 3" bolt spacing
3 = Welded plate w/3" X 3" bolt spacing</td></tr>
<tr><td>Surface Code
Default = A</td><td>Code the surface condition of bolted parts. See AASHTO Table 10.57A. (1995)

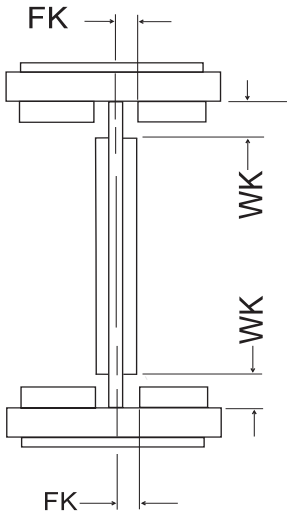
<table><tr><th>Class of Surface</th><th>Surface Condition of Bolted Parts</th></tr><tr><td>A</td><td>Clean mill scale and blast-clean surface width Class A coating</td></tr><tr><td>B</td><td>Blast-cleaned surface and blast-clean surfaces with Class B coating</td></tr><tr><td>C</td><td>Hot-dip galvanized surfaces roughened by wire brushing after galvanizing.</td></tr></table></td></tr>
<tr><td>Additional lines of transverse fasteners in top splice
Default = 0</td><td>Enter 1 if two additional lines of transverse fasteners are desired for the top flange splice because of the indirect splice condition, otherwise leave blank (see Note 4).</td></tr>
<tr><td>Additional lines of transverse fasteners in bottom splice
Default = 0</td><td>Enter 1 if two additional lines of transverse fasteners are desired for the bottom flange splice because of the indirect splice condition, otherwise leave blank (see Note 4).</td></tr>
<tr><td>Intermediate output
Default = 0</td><td>Enter 1 if intermediate output is desired for splice design. This feature will output the value of most calculations made during the splice design.</td></tr>
</table>

EXAMPLE

If a steel girder splice design using 500,000 cycles, clean mill scale surface condition, FK = 1.5 inches, WK = 2.5 inches, and welded plate with 4" X 4" spacing, the command would be coded as follows:

STEEL-5 L, 2, 1.5, 2.5, 1, A, , ,

FIGURES



NOTES

1. Steel splice design is done according to AASHTO 10.18 and Wyoming standard practice. For complete discussion of splice design assumptions and limitations consult BRASS-SPLICE documentation.

2. Load factors used in splice design are as follows:

Strength - Load Level 1:	$\gamma\ (\beta_{DL} * DL + \beta_{LL} * LL)$
Overload - Load Level 2:	$DL + \beta_{LL} * LL$
Fatigue - Load Level 4:	$\beta_{LL} * LL_{range}$

3. See PROPERTIES-ST1 for defining yield strength of splice plate material. See STEEL-1 for defining the shear strength of the girder used in the splice design as based on a stiffened or unstiffened girder.

4. Splice design does not consider eccentricity of forces at fillers as described in AASHTO 10.18.1.2 and 10.18.1.3.

5. Yield strengths for girder and splice plate material must conform to those in AASHTO Table 10.2A or may be entered less than 36 ksi. If entered less than 36 ksi, F_u will be taken as 52 ksi in the design calculations.

1066	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	STEEL-6	SL6
PURPOSE	This is the sixth in a series of commands to describe factors affecting the design or rating analysis of a particular point along the girder. This command is required for an ultimate strength design of a steel girder splice.	

5 COMMAND PARAMETERS

NRDS Default = 1	Code one of the following to indicate structure redundancy. 0 = Non-redundant type structure 1 = Redundant type structure
ITHRW Default = 0	Bolt threads included/excluded from shear plane of web splice plates. 0 = Bolt threads excluded from shear plane 1 = Bolt threads included in shear plane
ITHRDT Default = 0	Bolt threads included/excluded from shear plane of top flange splice plates. 0 = Bolt threads excluded from shear plane 1 = Bolt threads included in shear plane
ITHRDB Default = 0	Bolt threads included/excluded from shear plane of bottom flange splice plates. 0 = Bolt threads excluded from shear plane 1 = Bolt threads included in shear plane
IWTHR Default = 0	Weathering Steel Indicator 0 = Steel is not weathering steel 1 = Steel is weathering steel

EXAMPLE

A steel girder splice design for a redundant type structure, with bolt threads excluded from the shear planes of the web and top and bottom flanges, and weathering type steel, the command would be as follows:

STEEL-6 1, 0, 0, 0, 1

FIGURES

NOTES

Final determination of whether threads are in the shear plane may need to be decided after an initial splice run to determine the thickness of splice plates (see AASHTO 10.24.1.8).

1080	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CONCRETE-1	CR1
PURPOSE	This is the first in a series of two commands to describe factors affecting the design or rating analysis of a particular point along the girder. It is required when designing certain aspects of a reinforced concrete girder or rating a reinforced concrete girder for load capacity. This set of commands is required for each of up to 212 analysis points allowed.	

7 COMMAND PARAMETERS

Analysis Point	Enter the span point at which an analysis of the girder section is desired. Use the following format: 104 = 4/10 of distance from left end of span 1 along span 1. *106.5 = 65/100 of distance from left end of span 1 along span 1. See note below. 110 = 10/10 of distance from left end of span 1 along span 1. Basically this is the right end of span 1. 200 = 0/10 of distance from left end of span 2 along span 2. Basically this is the left end of span 2. *Note: Only 1/10 points may be analyzed on a span unless there is a node point at the desired location created by a cross-section change or a special analysis point from the HINGE command or TRANSFER command.
% Shear Default = 100.0	Enter the percent of concrete section to be used in resisting shear normal to the member. This may be used in the rating of a concrete section for shear when the section is wholly or partially cracked. See Notes.
Lightweight Concrete Shear factor Default = 1.0	If the girder is constructed of reinforced concrete with lightweight aggregates, enter the shear factor for lightweight concrete (see AASHTO 8.15.5.2). See Notes.
V_{DIST} Default = depth of section	If the analysis point under consideration is a support, enter the distance in feet from the centerline of the support to the shear face to be used for stirrup design. See Figure 1.
(Continued)	

COMMAND PARAMETERS (Cont.)	
θ_S Default = 90 °	If stirrups in the area of this analysis point are inclined, enter the angle in degrees between the stirrup and the horizontal. See Figure 2 and Notes.
Axial Load Indicator Default = 0	Enter 1 if axial load at this analysis point is to be ignored. This could apply in the case of a sidewall of a box culvert which is to be analyzed as a beam. See Notes.
Intermediate Output Default = 0 (no output)	Enter a 1 if a detailed output report is desired for most of the AASHTO Specification checks. This feature outputs intermediate values which aid in hand computations. It allows the user to see how BRASS-GIRDER™ calculates section flexural and shear capacity at the analysis point considered. Load Factor method only. Enter a 0 to suppress this report.

EXAMPLE

Assume analysis of the 2.0 point of a reinforced continuous concrete T girder is desired. The section is sound (no cracks), stirrups are vertical, normal weight concrete has been used, and shear is to be determined at 3 feet from the centerline of the supporting integral column:

CONCRETE-1 200, 100, , 3

FIGURES

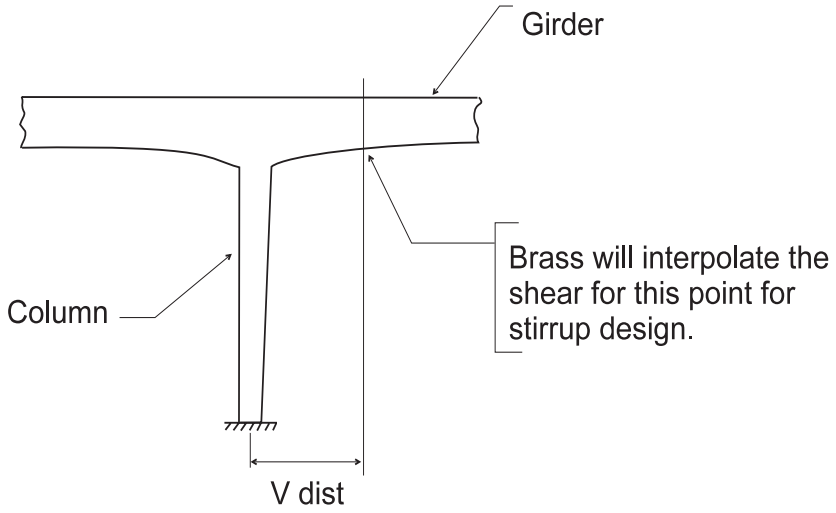


Figure 1

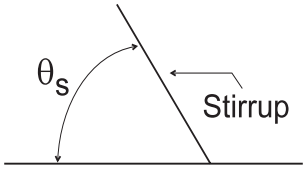


Figure 2

NOTES

If you have used the STIRRUP-GROUP and/or STIRRUP-SCHEDULE commands, this parameter (or any non-blank entry in this parameter) may be used to override the input from the commands listed above for the analysis point defined in parameter 1 of the CONCRETE-1 command. The default values for this command will not be activated for this override feature.

1090	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CONCRETE-2	CR2
PURPOSE	This is the second in a series of two commands to describe factors affecting the design or rating analysis of a particular point along the girder. It is required when designing a slab bridge or rating a girder bridge with stirrups.	

3 COMMAND PARAMETERS

Shear Indicator Default = 0	Enter 1 if shear is to be ignored as in the case of a reinforced concrete slab bridge (see AASHTO 1.3.2(F)). See Notes.
$A_{STIRRUPS}$	Code the area of reinforcing steel in a stirrup at or adjacent to this analysis point. This will generally be twice the area of the rebar making the stirrup. See Notes.
Stirrup Spacing	Enter the longitudinal spacing in inches between stirrup in the area of the analysis point under consideration. See Notes.

EXAMPLE

Assume a rating is desired of the 1.4 point of a reinforced concrete T-girder. Stirrups are rectangular made from #4 reinforcing steel and placed at 10 inch centers:

CONCRETE-2 , 0.40, 10

FIGURES

NOTES

If you have used the STIRRUP-GROUP and/or STIRRUP-SCHEDULE commands, this parameter (or any non-blank entry in this parameter) may be used to override the input from the commands listed above for the analysis point defined in parameter 1 of the CONCRETE-1 command. The default values for this command will not be activated for this override feature.

These components will design reinforced concrete box girders, T-girders and slab bridges with five or less spans by the load factor method. Two separate runs are used for the design of a superstructure. The first run is called the "Preliminary Run" and determines required areas and stirrup spacings at points along the bridge. The second run is called the "Final Run" and determines actual cutoff locations of bar groups. The output from the preliminary run will allow accurate selection of bar sizes, bar locations, bar groupings and cutoff preferences to be input for the final run. Each run utilizes data generated at tenth points of the spans by the "Structural Analysis Component" and "Structural Loading Component". Therefore, each run must include these components.

Either run allows the following options to be used:

1). Different concrete strengths can be considered for the top and bottom of a member.

2). Moments at the faces of interior supports can be used for design.

3). Compression flange widths can vary from span to span for design of positive reinforcement in T-girders. The width used for the reinforcement design will be the width near the center of the span as input for the Structure Analysis component.

4). Moments immediately right and left of an interior support can be of different magnitudes as a result of the different stiffnesses of the interior supports and superstructure.

Both runs for the reinforced concrete design uses constant flange thicknesses and web thicknesses throughout the bridge. The final run also uses a constant web depth throughout the bridge but the preliminary run will account for variable web depths. Neither run considers any axial or torsion loadings on the member. Slab bridges must be input using the web depth and thickness.

Stirrup spacings are given at a distance "d" from the face of the support as well as at the end of each span. The shear at "d" from the face of the support is determined by interpolating between the maximum shear values for the point at the end of the span and for the adjacent tenth point. In each run, if the centroid of the total steel area being checked for fatigue is outside of the compression zone, the minimum stress is taken as zero. If the centroid of the total steel area opposite of that being checked for fatigue is outside the compression zone, the compression steel area is taken as zero for determining the maximum stress.

The preliminary run checks requirements for flexure, distribution of flexural reinforcement at maximum moment locations, minimum reinforcing of AASHTO 8.17.1, maximum allowable reinforcing, continuing reinforcement into the supports for positive moment reinforcement, continuing reinforcement beyond the point of inflection for negative moment reinforcement, flexure bond for positive reinforcement according to AASHTO 8.24.2.3, and fatigue. Minimum required areas are given for the above conditions along with the maximum allowable area and stirrup spacings. If the reinforcing at the point considered does not undergo stress reversal, the minimum required area to meet fatigue requirements is only given if it could govern the design at that point.

When stress reversal does occur, a list is given of the minimum required tension area for an assumed area of compression reinforcement. The minimum compression area used is the minimum required area for flexure, continuing reinforcement or minimum reinforcing, while the maximum compression area considered will be the lesser of twice the minimum compression area, the maximum allowable

reinforcing area or the minimum compression area plus 33 square inches. The assumed areas of compression reinforcement are incremented by 1 square inch for the first six times and then incremented by 2 square inches until one of the above requirements is met. Some of the assumed compression areas with corresponding required tension areas will not be printed if the tension area is considered equal to the required tension area calculated for the minimum compression area given. For distribution of flexural reinforcement requirements, the value input for the maximum bar size is used with the area required for flexure to determine the minimum number of bars that will be considered.

The final run checks the same requirements as the preliminary run plus requirements of AASHTO 8.24.1.1, 8.24.1.2 and 8.24.1.4. Bar groups are input for each span and interior support according to the preference they are to be cut off. A desired cutoff location may be input and this will be the actual cutoff location, provided the group does not need to extend farther. When flexure reinforcement located within the width of the member used to compute shear strength is terminated in a tension zone, additional shear reinforcement will be given if needed to meet the requirements of AASHTO 8.24.1.4.1 and 8.24.1.4.2, if 8.24.1.4.3 is not met.

The final run will not be completed and the following noted, if requirements for flexure, fatigue or AASHTO 8.24.2.3 cannot be met for the maximum areas of reinforcing input or if the requirement for the maximum allowable reinforcement is not met. If the requirement for distribution of flexural reinforcement at maximum moment locations is not met, this will be noted but the run will be completed.

If fatigue governs the amount of maximum reinforcing required for a span or interior support, the number of groups required to meet fatigue can only be one greater than the number of groups required for flexure. If the requirements of AASHTO 8.24.2.3 are not met at an inflection point, the group required to extend to the inflection point to meet the requirement will be extended into the adjacent support. If the cutoff location of a group is given at the end of a span, it is assumed that the bars in the group will be adequately anchored. The requirements of AASHTO 8.24.1.2.1 are used to determine theoretical cutoff locations for all actual cutoffs not running into a support, to account for possible shifts in the moment diagrams.

The final run uses the moments of each live load case separately in determining inflection points and cutoff locations between tenth points.

As already mentioned, the final run allows the designer to input his preference for the order groups are to be cut off and also specify exact locations of desired cutoff points on either or both sides of a group. If desired cutoff locations are input, these locations need to be such that the preference for the order groups will be cutoff still is correct. In other words, an error may result if the value for a desired cutoff location results in a bar being terminated farther away from the maximum moment location than a termination point for a lower numbered group on the same side of the maximum moment location. If moments at the face of interior supports are used, desired cutoff locations should be input for the maximum group used over the interior support to assure proper development of that group.

If the cross section used by the program is different than the actual cross sections throughout the bridge or if the actual reinforcing details desired are different than that used by the program, some hand calculations and possible adjustments for things such as stirrup spacing or cutoff locations may be necessary after the appropriate run is made. Also, after the final run, sections in AASHTO not checked by this program, such as parts of 8.17.2, should be checked.

1100	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CONCRETE-3	CR3
PURPOSE	This command defines factors affecting the design of concrete girders by the Ultimate Strength Design method. This command is required for both the ultimate strength preliminary run and final run.	

6 COMMAND PARAMETERS

Shear Indicator Default = 0	Enter 1 if shear is to be ignored as in the case of a reinforced concrete slab bridge (see AASHTO 3.24.3).
Ratio - Fatigue Default = 0.3	Enter the ratio of base radius to height of rolled-on transverse deformation of the main reinforcing; when an actual value is not known use 0.30. This will be used to check Fatigue Stress limits (see AASHTO 8.16.8.3).
Span Length Indicator Default = 0	Enter indicator of span length to be used for interior supports in determining the effective tension flange width for a T-girder. 0 = Average of adjacent spans. 1 = Minimum of adjacent spans. 2 = Maximum of adjacent spans.
Left ℓ_A	Enter the additional embedment length in inches, ℓ_A, at the left simple support for flexural bond requirements (see AASHTO 8.24.2.3).
Right ℓ_A	Enter the additional embedment length in inches, ℓ_A, at the right simple support for flexural bond (see AASHTO 8.24.2.3).
Z Default = 170	Enter value of Z for distribution of flexural reinforcement requirements (see AASHTO 8.16.8.4).

EXAMPLE

Assume a three span reinforced concrete T-girder with moderate exposure conditions is being designed. Span #1 is 48 feet, span #2 is 63 feet and span #3 is 48 feet. The ratio for the reinforcing bars being used is unknown and an average of the span lengths is desired to be used at the interior supports. The value of ℓ_A at both ends of the bridge is 13 inches.

CONCRETE-3 , , , 13, 13

FIGURES

NOTES

1110	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CONCRETE - 4	CR4
PURPOSE	This command defines distances and the location of reinforcement from the extreme tension fibers. Each distance input to the centroid of the total positive reinforcement will be analyzed and required areas of steel at locations throughout the bridge will be given. This command is required for the ultimate strength preliminary run.	

6 COMMAND PARAMETERS

Top Cover	Enter the minimum thickness of concrete cover in inches from the top extreme tension fiber to the center of the negative reinforcing bar closest to it. This will be used for all locations for the negative reinforcement in checking distribution of flexure reinforcement requirements.
Bottom Cover	Enter the minimum thickness of concrete cover in inches from the bottom extreme tension fiber to the center of the positive reinforcing bar closest to it. This will be used for all locations for the positive reinforcement in checking distribution of flexure reinforcement requirements.
Positive Distance $_1$	Enter first distance in inches from extreme tension fiber to centroid of total positive reinforcement.
Positive Distance $_2$	Enter second distance in inches from extreme tension fiber to centroid of total positive reinforcement.
Positive Distance $_3$	Enter third distance in inches from extreme tension fiber to centroid of total positive reinforcement.
Box Girder	Enter 1 if this is a reinforced concrete box girder section.

EXAMPLE

Assume a preliminary run is desired for a reinforced concrete T-girder. The clearance at the bottom will be 1.5 inches of clear cover over the stirrup. The stirrup is assumed to be a #5 bar and #10 bars in the bottom layer are assumed to be the approximate bar size which will extend into the supports. The top of the T will have #6 bars running transversely which have 2.5 inches of clear cover over them. The negative reinforcing will be in a single layer directly below the transverse reinforcing and is assumed to be #8 bars for the preliminary run. It is assumed that the total positive reinforcing will consist of two rows with an approximate spacing between the rows of 3.5 inches. Three different locations for the total positive reinforcing is considered adequate to size the bars for the final run.

```
CONCRETE-4          3.75,      2.76,      2.76,      4.16,      4.51
```

FIGURES

NOTES

1120	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CONCRETE-5	CR5
PURPOSE	This command defines the distance and location of the centroid of each total negative reinforcing group to be considered in the ultimate strength preliminary run. Each distance input to the centroid of the total negative reinforcement will be analyzed and required areas of steel at locations throughout the bridge will be given. Also maximum bar sizes and steel areas are input.	

6 COMMAND PARAMETERS

Negative Distance $_1$	Enter first distance in inches from extreme tension fiber to centroid of total negative reinforcement.
Negative Distance $_2$	Enter second distance in inches from extreme tension fiber to centroid of total negative reinforcement.
Max. Bar Size (Positive)	Enter the maximum bar size which should be considered for positive moment reinforcement.
Max. Bar Size (Negative)	Enter the maximum bar size which should be considered for negative moment reinforcement.
Stirrup Area $_1$	Enter the area of stirrups in sq. in. which the required maximum spacing will be determined for.
Stirrup Area $_2$	If desired, enter a second area of stirrups in square inches which the required maximum spacing will be determined for.

EXAMPLE

Using the example for CONCRETE-4, the single layer of negative reinforcing will be input along with bar sizes noted which will be considered maximum sizes to be used. Spacing for #5 stirrups is desired.

```
CONCRETE-5        3.75,      ,      10,      8,      0.62
```

FIGURES

NOTES

1130	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CONCRETE-6	CR6
PURPOSE	This is the first of a series of commands (CONCRETE-6, CONCRETE-7, and CONCRETE-8) required to define reinforcement groups for which cutoff locations will be determined. A series is required for each span. This series is required only for the ultimate strength final run. For the preliminary or final run of a box-girder, entries 5 & 6 are needed for distribution of flexure reinforcement requirements.	

6 COMMAND PARAMETERS	
Span No.	Enter the number of the span for which positive reinforcement is to be described. Spans shall be numbered in consecutive order from left to right, starting with No. 1.
Number of Top Reinforcing Groups	Enter the total number of groups of negative reinforcement to be input which are to be located over the interior support at the right of the designated span. Leave blank if support at right is an exterior support.
Number of Bottom Reinforcing Groups	Enter the total number of groups of positive reinforcement to be input for this span.
Clear Span Length	Enter the clear span length in feet for this span.
Box Girder's Bottom Flange Effective Tension Width	Enter the effective tension flange width in inches to be used for the reinforcement in the bottom flange of this span.
Box Girder's Top Flange Effective Tension Width	Enter the effective tension flange width in inches to be used for the top flange reinforcement located over the interior support at the right of the designated span. Leave blank if support at right is an exterior support.

EXAMPLE

Assume span #1 of a three span T-girder is being defined. The negative reinforcing over the first interior support which will continue into spans #1 and #2 is desired to have half of the bars terminated before they reach the point of inflection. The positive reinforcing which is not required to continue into the supports is desired to be cutoff at two different locations on each side of the point of maximum positive moment. The clear span for span #1 is 45 feet.

```
CONCRETE-6          1,      2,      3,      45
```

FIGURES

NOTES

1140	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CONCRETE-7	CR7
PURPOSE	This command is to define each positive or negative reinforcing group. This command will be used and followed by as many CONCRETE-8 commands as required to define the first group and then repeated with the same sequence of commands until all positive and negative groups for the designated span have been defined.	

6 COMMAND PARAMETERS	
Reinforcement Type	Enter 1 if group of positive reinforcement is to be defined. Enter 2 if group of negative reinforcement is to be defined.
Group No.	Enter the designated number of the group to be defined. Numbers must be in consecutive order starting with one for both positive and negative reinforcement. Group #1 shall be the group most preferred to continue into the supports for positive reinforcement or to extend beyond the point of inflection for negative reinforcement. Group No. 2 shall be that group desired to be cutoff farthest from the point of maximum moment (not considering Group No.1). Group No. 3 shall be the next farthest and so on.
Number of bars or bar sets in group	Enter the total number of bars and/or bar sets in the group.
Basic development length factor Default = 1	Enter the factor for this group to be taken times the basic development length according to AASHTO 8.25.
Left Cutoff Distance (Optional)	Enter distance in feet to where actual left cutoff location is desired. For positive reinforcement, this distance is measured left of the mid-point of the span. For negative reinforcement, this distance is measured left of the end of the span at an interior support. This cutoff location will be used only when it is determined that this group will not be required to extend past this location.
Right Cutoff Distance (Optional)	Enter distance in feet to where actual right cutoff location is desired. For positive reinforcement, this distance is measured right of the mid-point of the span. For negative reinforcement, this distance is measured right of the end of the designated span at an interior support. This cutoff location will be used only when it is determined that this group will not be required to extend past this location.

EXAMPLE

Assume that we are defining Group 2 of the positive reinforcement of span 1 whose span length is 48 feet. It is desired that Group 2 should extend into the abutment and extend as far as required right of the point of maximum positive moment. According to the AASHTO Specification a value of 0.8 should be multiplied times the basic development length of this group.

CONCRETE-7 1, 2, 3, 0.8, 24

FIGURES

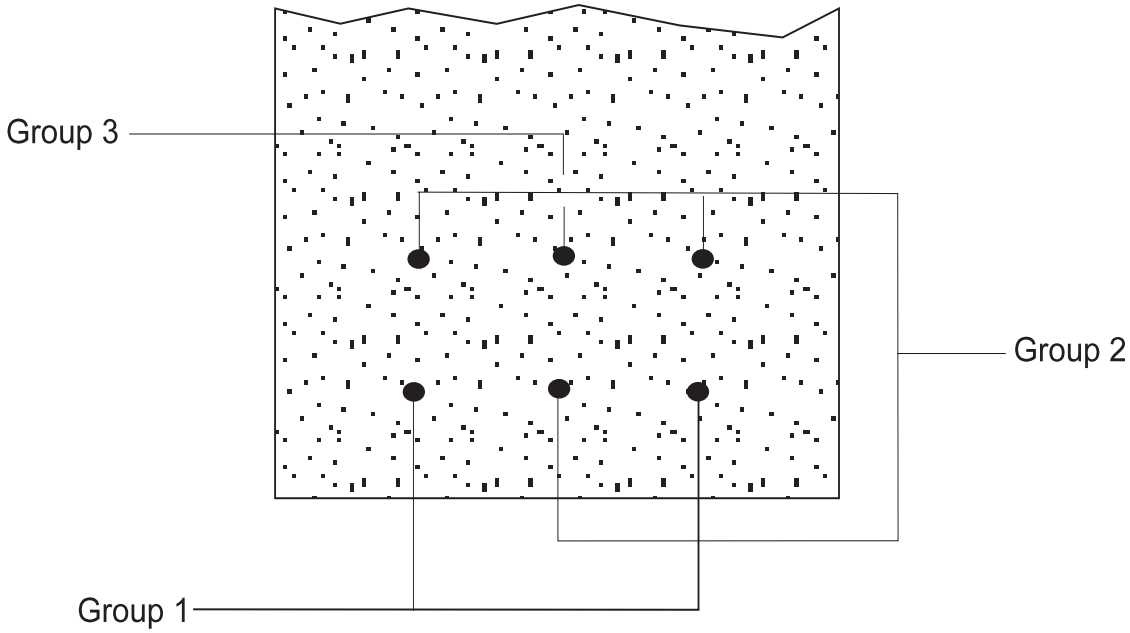


Figure 1

NOTES

In Figure 1 shown above, Group 1 will be extended into the supports and Group 3 will be the first group to be cutoff with is termination point closest to the point of maximum positive moment. The group being defined, No. 2, will be the second group to be cutoff on the right side of the span while it will run into the abutment on the left side of the span.

1150	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CONCRETE-8	CR8
PURPOSE	This command defines reinforcing bars that are in the group previously defined by the CONCRETE-8 command. Each bar in the group must be defined. This must be done by inputting each individual bar separately unless bars of the same size and same distance to nearest extreme fiber are input as a group using the correct percent of area to give the total area. Repeat this command until all bars in group are defined.	
6 COMMAND PARAMETERS		
Bar Size	Enter the bar size. The minimum bar size is a #3 and the maximum is a #14.	
D_1	Enter the distance in inches from the centroid of the bar to the nearest extreme fiber.	
Percent of area Default = 100	Enter percent of area of given bar size to be used.	
Bar Size	Enter the bar size. The minimum bar size is a #3 and the maximum is a #14.	
D_1	Enter the distance in inches from the centroid of the bar to the nearest extreme fiber.	
Percent of area Default = 100	Enter percent of area of given bar size to be used.	

EXAMPLE

Assume that three #10 bars identified in Figure 1 comprise a group whose bars are being defined.

CONCRETE-8 10, 2.75, , 10, 6.25, 200

FIGURES

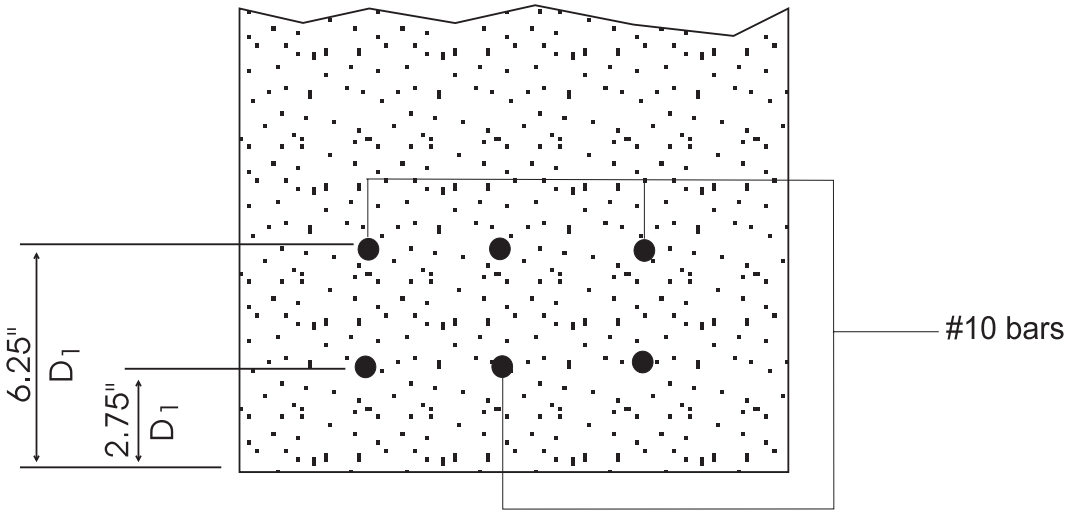


Figure 1

NOTES

The two bars in the top row of this group could have been entered first if desired, since bars of a group may be entered in any order regardless of size or location.

1160	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	CONCRETE-9	CR9
PURPOSE	This command defines flexural bond considerations at simple supports, design moments at faces of interior support and shear reinforcements. This command is required for the ultimate strength preliminary and final runs. Entry No. 1 is needed only for the final run while all other entries are required or optional for both runs.	

6 COMMAND PARAMETERS	
A stirrups	Code the area of reinforcing steel in sq. in. for a stirrup whose spacing will then be determined for the final run.
Distance (Interior Support Face)	Enter distance from end or beginning point of span lengths input to face of interior support in inches. This will be used to calculate the shear value at 'd' from the face of the support.
Distance (Exterior Support Face)	Enter distance from end or beginning point of span lengths input to face of exterior support in inches. This will be used to calculate the shear value at 'd' from the face of the support.
Left Compressive Reaction	Enter 1 if reinforcement running into the left simple support is not considered confined by a compressive reaction for checking flexural bond requirements (see AASHTO 8.24.2.3).
Right Compressive Reaction	Enter 1 if reinforcement running into the right simple support is not considered confined by a compressive reaction for checking flexural bond requirements (see AASHTO 8.24.2.3).
Distance (Interior Support Face) Moment	If design moment is desired to be taken at face of interior supports enter distance in inches from end or beginning point of span lengths input to face of interior support.

EXAMPLE

Assume a reinforced concrete T-girder is being designed under the final run using single #5 stirrups. The reinforcing running into both abutments are considered confined by a compressive reaction for the maximum shear force at the abutments. The distance from the end point of the exterior span to the face of the abutment is 1'3" and the distance from the end point of the interior spans to the face of the interior supports is 1'9". Design moments are not desired at the face of the support.

CONCRETE-9 .62, 21, 15

FIGURES

NOTES

1170	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PRESTRESS-1	PR1
PURPOSE	This is the first in a series of two commands to describe factors affecting the rating of a particular point along the girder. It is required when rating a prestressed girder for load capacity. This series of commands is required for each of up to 212 analysis points allowed. See Note 1.	

10 COMMAND PARAMETERS

Analysis Point	Enter the span point at which an analysis of the girder section is desired. Use the following format: 104 = 4/10 of distance from left end of span 1 along span 1. *106.5 = 65/100 of distance from left end of span 1 along span 1. See note below. 110 = 10/10 of distance from left end of span 1 along span 1. Basically this is the right end of span 1. 200 = 0/10 of distance from left end of span 2 along span 2. Basically this is the left end of span 2. *Note: Only 1/10 points may be analyzed on a span unless there is a node point at the desired location created by a cross-section change or a special analysis point from the HINGE command or TRANSFER command.
f^*_{SU} Default to AASHTO 9.17.4	Enter the average stress in the prestressing steel at ultimate load, in ksi, for strands defined as Strand Code #1 on the STRAND-ST1 Command.
f^*_{SU} Default to AASHTO 9.17.4	Enter the average stress in the prestressing steel at ultimate load, in ksi, for strands defined as Strand Code #2 on the STRAND-ST1 Command.
f^*_{SU} Default to AASHTO 9.17.4	Enter the average stress in the prestressing steel at ultimate load, in ksi, for strands defined as Strand Code #3 on the STRAND-ST1 Command.
(Continued)	

COMMAND PARAMETERS (Cont.)	
M_N+	IMPORTANT: See Notes 2 and 3 for the following two parameters. Enter the nominal moment capacity, in ft-kip, for positive moment.
M_N -	Enter the nominal moment capacity, in ft-kip, for negative moment. (Input as a positive value.)
Leave Blank	Leave this parameter blank.
Leave Blank	Leave this parameter blank.
Leave Blank	Leave this parameter blank.
Intermediate Output For Shear Default = 0 (not output)	Enter a 1 if a detailed output report, for shear only, is desired for most of the AASHTO Specification checks. This feature outputs intermediate values which aid in hand computations. Enter a 0 to suppress this report.

EXAMPLE

Assume this is a prestressed girder, simple span for DL made continuous for LL by reinforcement over the support in the composite slab. The moment capacity at the support is 1831.6 ft-k for negative moment and 497.2 ft-k for positive moment. The 2.0 and 2.5 span points are to be rated. Two PRESTRESS-1 commands would be required.

```
PRESTRESS-1     200
PRESTRESS-2     497.2,     1831.6
PRESTRESS-1     205
```

FIGURES

NOTES

1. The operating rating is based on the ultimate moment capacity of the section. Therefore, the tensile stress of the prestressed strand is not checked.

2. Normally, BRASS computes the positive and negative moment capacities based on the properties and configuration of the girder and strands. A feature was included in BRASS which allows the user to override the calculated strength of the section based on observed cracking, girder damage, other deterioration, or other engineering logic pertinent to the evaluation of the structure. Inputting values for the following two parameters instructs BRASS to bypass the computation of moment capacities and use the values input by the user. These parameters are intended to only increase or decrease the moment capacity and should not be used to model a section using moment capacities only.

   As always, strand information must be input using the PROPERTIES-PC2 and STRAND-ST* commands. This information is used in the computation of secondary moments due to prestress loss.

3. If a moment capacity is 0, it must be coded as 0, and not as a blank. Otherwise the program will attempt to calculate a moment capacity.

1180	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PRESTRESS-2	PR2
PURPOSE	This is the second in a series of two commands to describe factors affecting the rating of a particular point along a prestressed girder. It may be used when the user desires to check the load capacity based on a moment capacity when the stress in the layer of tendons nearest the extreme tension fiber reach 90% of the yield point stress and the user desires to input the moment capacity.	
2 COMMAND PARAMETERS		
$M_{90\%}$+	Enter the moment capacity based on 90% yield stress in extreme tension row of strands, in ft-k, for positive moment.	
$M_{90\%}$ -	Enter the moment capacity based on 90% yield stress in extreme tension row of strands, in ft-k, for negative moment. Enter as a positive number.	

EXAMPLE

Assume this is a prestressed box-girder, working stress analysis. The moment capacity of the section when strand nearest the extreme tension fiber reaches 90% of the yield point stress is 54691 ft-k for positive moment and 0 for negative moment.

```
PRESTRESS-2        54691,      0
```

FIGURES

NOTES

If the moment capacity is 0.0 it must be coded as 0, and not as a blank, otherwise the program will attempt to calculate a moment capacity.

Prestressed Concrete Girder Design

This component will design prestressed concrete girders in accordance with AASHTO specifications. Either simple-span structures or structures that are simple-span for dead load and made continuous for live load may be designed.

Table 1 lists the output reports available. Reports 1 through 31 are printed as a group, span by span. Reports 32 through 40 pertain to the structure as a whole and are printed after Reports 1 through 31. Reports 12 through 32 and 34 through 40 may be eliminated by entering 1 in parameter 3 of the SYSTEM-1 command "Minimum Output". Also, entering a 1 in parameter 4 of the SYSTEM-1 command instead of parameter 3 will eliminate the above reports only where overstressing occurs. Reports 19 through 28 will only be printed if 1 is entered in parameter 5 of the SYSTEM-1 command "Detailed output of stirrup spacing" and "Minimum output" has not been specified.

Note: When performing a Prestressed Concrete Girder Design, a minimum of two trucks (HS20T and LANEHS20) are required to run the program.

The main part of the current Kansas Prestress Module was written approximately 25 years ago and now contains over 10,000 lines of code. The program was written as a manual iteration design tool with the following analysis steps in mind.

a) The engineer makes a guess for the strand eccentricitics at the center and ends of the beam. He runs the program in design mode to have it calculate the number of strands required.

b) Using the number of strands obtained from step a) as a reference, the engineer manually calculates eccentricities for actual strand patterns at the center and beam ends. Using the program in analysis mode with minimal output, he checks the output for overstresses for the input strand quantity and eccentricities.

c) Step b) is repeated with new strand eccentricities and strand quantities until overstresses are eliminated and an optimized design is achieved.

d) The engineer then turns on detailed output and enters the final strand quantities and eccentricities. The program will then report final analysis results for stress checks, negative moment slab reinforcing steel requirements, beam to slab shear stirrup requirements, and positive restraint moment checks.

The Prestressed Concrete Girder Design component was developed by the Kansas Department of Transportation. Questions pertaining to design parameters and analysis methods may be directed to:

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Report No.	Report Description
1	Dimensions and Properties
2	P*S Steel Properties & Losses
3	Dead Load Moments at Tenth Points
4	Dead Load Shear at Tenth Points
5	Design Shear, Moment & Reactions
6	Cable Profile
7	Horizontal and Vertical P*S Forces
8	Dead Load Stresses
9	Beam Stresses due to Live Load & P*S Forces
10	Beam Stresses due to Dead Load Plus P*S Forces
11	Beam Stresses at Initial & Final Conditions
12	Slab Stresses due to Dead and Live Load
13	Ultimate Moment Computations - Reinforcement Index, Depth of Compression Block, etc.
14	Ultimate Moments Required and Provided for Positive Live Load Moment
15	Ultimate Moments Required for Negative Live Load Moment
16	Ultimate Shear
17	Computed Stirrup Spacing (1979 Interim 1.6.13)
18	VCW - Positive Moment - Nominal Shear Strength Provided by Concrete When Diagonal Cracking Results From Excessive Principal Stress in Web
19	Positive Cracking Moment for Shear Design
20	VCI - Positive Moment - Nominal Shear Strength Provided by Concrete When Diagonal Cracking Results from Combined Shear and Moment
21	Maximum Ultimate Shear - Positive Moment
22	Stirrup Spacing - Positive Moment Depth of Beam
23	VCW - Negative Moment
24	Maximum Ultimate Shear - Negative Moment
25	Negative Cracking Moments for Shear Design
26	VCI - Negative Moment
27	Stirrup Spacing - Negative Moment Depth of Beam
28	Stirrup Spacing Summary - Positive Moment Condition
29	Stirrup Spacing Summary - Negative Moment Condition
30	Final Stirrup Spacing Summary
31	Horizontal Shear Between Slab and Top of Beam
32	Deflections
33	Summary of Support Reactions
34	PCA Method - Summary of Final Stresses with Restraint Moment Analysis
35	PCA Method - Summary of Restraint End Moments and Analysis Values
36	PCA Method - Design of Extended P*S Strands to Resist Positive Restraint Moment
37	PCI Method - Summary of Final Stresses with Restraint Moment Analysis
38	PCI Method - Summary of Restraint End Moments and Analysis Values
39	PCI Method - Design of Extended P*S Strands to Resist Positive Restraint Moment
40	Comparison of Stresses and End Strand Design for Positive Moment Connection by PCA and PCI Method

Table 1 - Prestress Girder Design
Description of Output Reports

1181	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PRESTRESS-3	PR3
PURPOSE	This is the first in a series of two commands to define factors affecting the design of prestressed concrete girders. This set of commands is required for each span. Prestressed girder DESIGN only.	

10 COMMAND PARAMETERS	
Span	Enter the number of the span.
Beam Length	Enter the beam length, in feet. See Figure and Note 1.
Actual Slab Thickness	Enter the thickness of the composite slab, in inches.
DELTA-B	Enter the weight of any additional dead loads, in kips per foot, to be added to the beam weight. These are loads that will be present when the prestessing force is applied. This could include stay-in-place box beam forms, decorative elements running the length of the girder, or any other beam add on weights. The beam self-weight itself will be calculated by the program using the input beam dimensions and concrete unit weight.
DELTA-S	Enter the weight of any additional slab dead loads, in kips per foot, which are added to the non-composite slab weight. This could include the weight of the non-composite dead load of the slab outside the effective flange width region, soffits, slab thickening, and fillets. The non-composite slab dead load within the effective flange width region will be calculated by the program using the input slab thickness, effective flange width and concrete unit weight.
DELTA-C	Enter the weight of any curbs, railing, or medians, in kips per foot, to be added as composite dead loads. Any future wearing surface dead loads should be entered using the next parameter. See Note 2.
FWS (Continued)	Enter the weight of the Future Wearing Surface for Span-1 in Kips per foot. This is the weight of the FWS applied along the girder line. This parameter is required to allow the Kansas Prestress Design module to make comparisons between designs with and without the FWS. If this value changes from span-to-span the additional Stage 2 dead loads for subsequent spans can be defined using the appropriate LDE, UL1, and PTD, commands (840, 850, and 860 respectively). Keep in mind that all comparisons will be based on the value of the FWS for Span-1. See Note 2.

COMMAND PARAMETERS (Cont.)	
JFORCE	Enter 0 if the program is to determine the number of prestressing strands and compute the values for ALOSS and PSI. The AASHTO Method will be used. Enter 1 if the number of strands and values for ALOSS and PSI are to be input. Enter 2 if the number of strands is to be input and the program is to compute the values of ALOSS and PSI. The AASHTO Method will be used.
ALOSS (Total losses minus release losses)	If JFORCE is 1, enter the prestressing losses after release (ALOSS), in kips per square inch. If JFORCE is 0 or 2, leave blank and the program will calculate prestressing losses (AASHTO) after release.
PSI (Jacking force minus release losses)	If JFORCE is 1, enter the initial prestressing force after jacking losses (PSI), in kips. If JFORCE is 0 or 2, leave blank.

EXAMPLE

PRESTRESS-3 1, 84.167, 8.5, 0, .035, .034, .200, 0

Span 1
Beam Length = 84.167 ft.
Actual Slab Thickness = 8.5 in.
DELTA-B = 0
DELTA-S = 35 lb./ft.
DELTA-C = 34 lb./ft.
FWS = .200 kips/ft.
JFORCE = 0 (Program will compute number of strands, ALOSS and PSI)

FIGURES

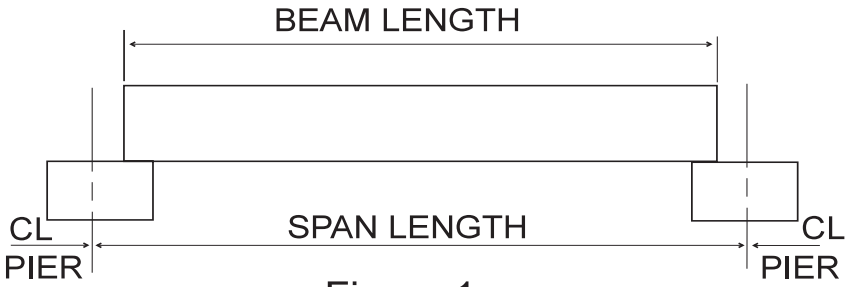


Figure 1

NOTES

1. If the beam length exceeds the span length, enter the span length.

2. If you wish to have Stage 2 dead load vary in a general way, leave Parameter-6 (DELTA-C) blank and enter only the Span-1 FWS. Adjustments for Span-2 and subsequent spans can be made by entering the appropriate LDE, UL1, and PTD commands (840, 850, and 860 respectively). These commands are entered following the DLD command. For example, if the superstructure dead load for Stage 2 changes from Span-1 to Span-2 (i.e., possibly due to a change in girder spacing) an adjustment from the value entered for FWS of Span-1 can be made up or down by defining additional Stage 2 dead loads using the appropriate LDE, UL1, and PTD commands for the span under consideration. Keep in mind that all comparisons are still based on the value of the FWS for Span-1.

3. Loads entered in the DEAD-LOAD command will be overwritten by loads entered this command.

1182	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PRESTRESS-4	PR4
PURPOSE	This command defines the location and weight of the diaphragms for prestressed concrete girders. This command must follow a PRESTRESS-3 command. Prestressed girder DESIGN only.	

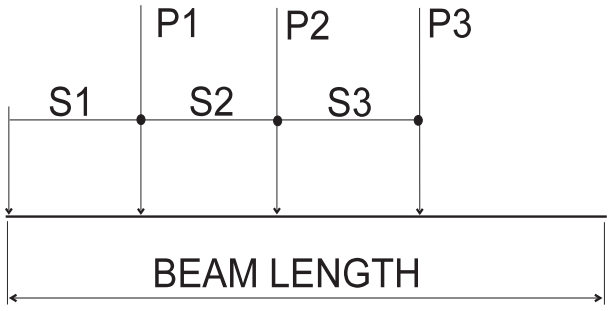
6 COMMAND PARAMETERS	
S1	Enter the distance from the left end of the span to the first diaphragm, in feet.
S2	Enter the distance between the first and second diaphragms, in feet.
S3	Enter the distance between the second and third diaphragms, in feet.
P1	Enter the weight of the first diaphragms, in kips.
P2	Enter the weight of the second diaphragm, in kips.
P3	Enter the weight of the third diaphragm, in kips.

EXAMPLE

PRESTRESS-4 42.08, , , 3.30

FIGURES

Diaphragm load & position sketch.



NOTES

1183	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PRESTRESS-5	PR5
PURPOSE	This command defines the allowable tension stresses and the allowable compressive stress in the composite slab. This command is optional. Prestressed girder DESIGN only.	

4 COMMAND PARAMETERS

TENLL Default = 0 ksi	Enter the allowable tension in the bottom of the girder when the structure is fully loaded, in kips per sq. in.
TENBB Default = 3xSQRT (f 'c prestressed)	Enter the allowable tension in the bottom of the girder after creep and shrinkage losses, in kips per sq. in. See Note.
TENTB Default = 3xSQRT (f'_{ci} prestressed)	Enter the allowable tension in the top of the girder at release, in kips per sq. in. See Note.
F_C - SLAB Default = 0.40 f 'c slab	Enter the allowable compressive stress in the composite slab, in kips per sq. in.

EXAMPLE

PRESTRESS-5 .100

Allowable tension when fully loaded = 100 psi
All other values default.

FIGURES

NOTES

For a zero allowable tension, enter 0.001.

1184	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PRESTRESS-6	PR6
PURPOSE	This command defines the area of shear reinforcement, age of the girder at continuity, length of extension of prestressing strand, and type of curing. This command is optional. Prestress girder DESIGN only.	

4 COMMAND PARAMETERS

A_V Default = 0.40 sq.in.	Enter the area of one stirrup, in sq. in.
Age Default = 35 days	Enter the time, in days, between casting of the girder and the girder becoming continuous.
Extension Default = 36 in.	Enter the length of the extension of the prestressing strand from the ends of the girder, in inches.
Curing	Enter MOIST for moist curing of the girder or STEAM for steam curing.

EXAMPLE

PRESTRESS-6 , 30, , MOIST

Stirrup area defaults to 0.4 sq. in.
Girders made continuous at 30 days.
Extension length defaults to 30 in.
Moist curing.

FIGURES

NOTES

1190	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	TIMBER	TMB
PURPOSE	This command defines factors affecting the rating of a particular point along a timber girder. It is required when rating a timber girder for load capacity for each of up to 212 analysis points.	

4 COMMAND PARAMETERS

Analysis Point	Enter the span point at which an analysis of the girder section is desired. Use the following format: 104 = 4/10 of distance from left end of span 1 along span 1. *106.5 = 65/100 of distance from left end of span 1 along span 1. See Note below. 110 = 10/10 of distance from left end of span 1 along span 1. Basically this is the right end of the span 1. 200 = 0/10 of distance from span 2. Basically this is the left end of span 2. *Note: Only 1/10 points may be analyzed on a span unless there is a node point at the desired location created by a cross-section change or a special analysis point from the HINGE command.
LB	If the analysis point under consideration is at a support, enter the length of bearing in inches. See B in Figure 1.
DB	If the analysis point under consideration is at a support enter the distance in inches from the end of the member to the beginning of the bearing area. See DB in Figure 1.
WB	If the analysis point under consideration is at a support enter the width of the bearing area in inches. See WB in Figure 1.

EXAMPLE

Assume it is desired to rate the 1.0 and the 1.5 span points on a timber girder. WB, DB, and LB are 4, 12, and 10 inches respectively. Two TIMBER commands would be required.

```
TIMBER 100,      10,      12,      4
TIMBER 105
```

FIGURES

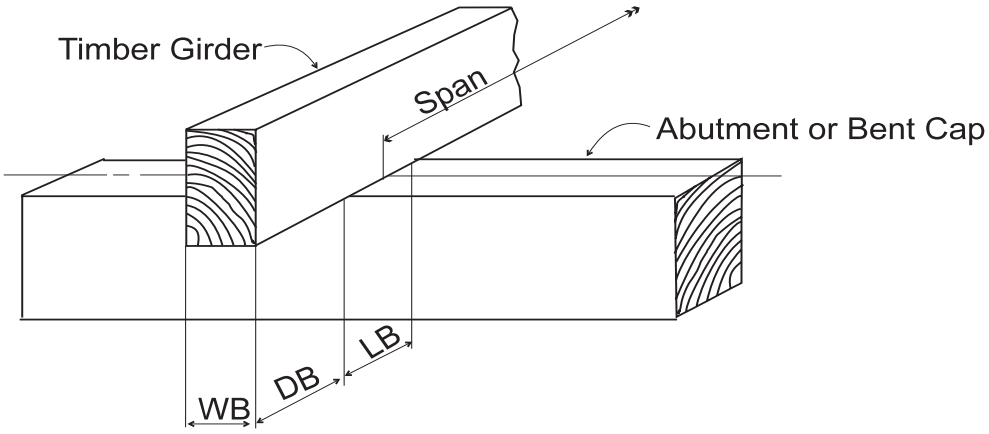


Figure 1

NOTES

15. TRUCK & STANDARD CROSS SECTION LIBRARIES

BRASS-GIRDER™ has two permanent, updatable libraries which contain descriptive data for trucks and standard cross sections. This section describes the libraries and the commands required to print, change, or add to the libraries. As currently defined, the libraries will hold data for up to 200 trucks and up to 2,000 standard cross sections.

The library capacity may be expanded if necessary, however, a computer programmer would be required.

Note: A separate executable program must be run to make changes to the libraries (util.exe). The commands in this section will not execute in the same program as those commands preceding this section. Users can execute this program from the "EXECUTE" drop down menu in the Graphical User Interface (Run Library Maintenance) or by entering:

"C:\BGIRDER\EXE>UTIL filename.DAT filename.OUT"

The END command may not be used when performing library maintenance.

Standard Shapes Library - Elements Required

Keyfield - User input of to 12 alpha numeric characters

Examples: W12X56, AASHTO-IV, WYO-ST6

Library elements:		Field Description:
1.	Section Designation	A12
2.	Description of Section	40 Characters
3.	Nominal Depth (Inches)	F6.1
4.	Weight per foot (Lbs)	F7.2
5.	Area (Sq. In.)	F7.2
6.	Actual Depth (Inches)	F6.2
7.	Top Flange Width (Inches)	F7.3
8.	Bottom Flange Width (Inches)	F7.3
9.	Top Flange Thickness (Inches)	F6.3
10.	Bottom Flange Thickness (Inches)	F6.3
11.	Top Web Width (Inches)	F6.3
12.	Bottom Web Width (Inches)	F6.3
13.	Web Depth (Inches)	F7.3
14.	Moment of Inertia X axis (In4)	F10.1
15.	Moment of Inertia Y axis (In4)	F10.1
16.	Z Plastic Modulus Y axis (In3)	F9.1
17.	Z Plastic Modulus X axis (In3)	F9.1
18.	Top Cover Plate Width (Inches)	F7.3
19.	Bottom Cover Plate Width (Inches)	F7.3
20.	Top Cover Plate Thickness (Inches)	F7.3
21.	Bottom Cover Plate Thickness (Inches)	F6.3
22.	Clearance top of top flange to bottom of top cover plate (Inches)	F6.3
23.	Clearance bottom of bottom flange to top of bottom cover plate (Inches)	F6.3

24. Distance from bottom of bottom flange to x-x neutral axis (Inches) F6.3

25. Taper dimension F1 (Inches) F7.3

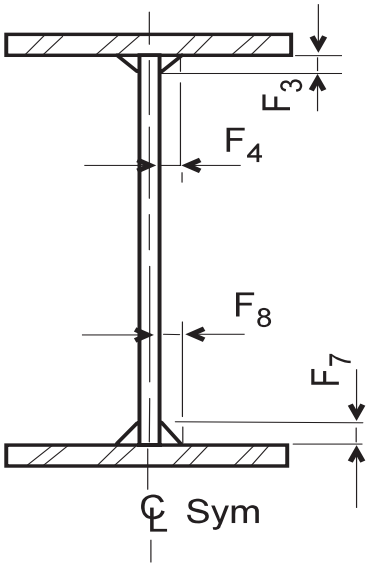


Figure 1

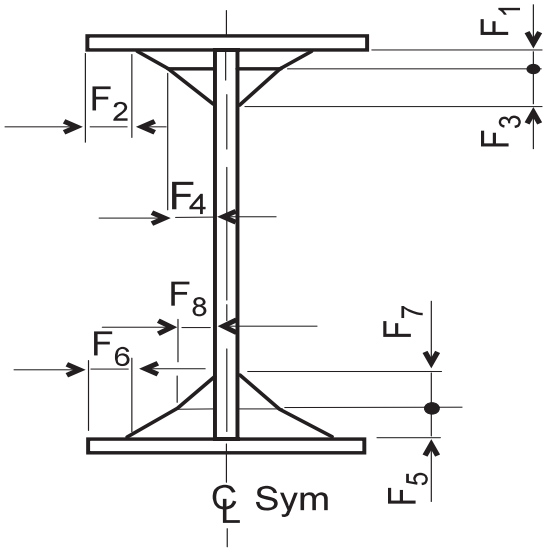


Figure 2

26. Taper dimension F2 (Inches) F7.3

27. Fillet dimension F3 (Inches) F7.3

28. Fillet dimension F4 (Inches) F7.3

29. Taper dimension F5 (Inches) F6.3

30. Taper dimension F6 (Inches) F6.3

31. Fillet dimension F7 (Inches) F6.3

32. Fillet dimension F8 (Inches) F6.3

33. Distance above centroid to analysis plane number 1 (Inches) F7.3

34. Distance above centroid to analysis plane number 2 (Inches) F7.3

35. Distance above centroid to analysis plane number 3 (Inches) F7.3

36. Distance below centroid to analysis plane number 5 (Inches) F7.3

37. Distance below centroid to analysis plane number 6 (Inches) F7.3

38. Distance below centroid to analysis plane number 7 (Inches) F7.3

39. 35 Blank Characters.

Truck Library - Elements required

Keyfield - User input up to 12 alpha numeric.

Examples: HS20T, LANEHS20, MILITARY

Library Elements:		Field Description:
1.	Truck Code	A12
2.	Uniform weight per foot for lane load equivalent to one wheel line (Kips/ft)	F7.3
3.	Concentrated load for shear for one wheel line (Kips)	F7.3
4.	Concentrated load for moment for on wheel line (Kips)	F7.3
5.	Total weight of truck (Tons)	F7.3
6.	14 Blank Characters	
7.	Description of truck	40 Characters
8.	Weight of wheel load #1 (Kips) Axle weight - 2	F7.3
9.	Distance to axle #1 (always 0.0)	F7.3
10.	Weight of wheel load #2 (Kips) Axle weight - 2	F7.3
11.	Spacing from axle #1 to axle #2 (Feet)	F7.3
	Repeat for each axle up to 24 axles.	
54.	Weight of wheel load #24 (Kips) Axle weight - 2	F7.3
55.	Spacing from axle #23 to axle #24 (Feet)	F7.3

1200	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	NEW-TRUCK-1	NT1
PURPOSE	This command adds a lane load type of truck to the "Truck Library" or updates an existing lane load type of truck on the truck library. To update, enter the truck code and the parameter(s) that are to be changed. This command is required for adding either a truck or lane load to the "Truck Library".	

5 COMMAND PARAMETERS

Truck Code (Required)	Up to 11 alpha numeric characters to identify the truck to be described by the following parameters. If updating an existing entry be sure to use exactly the same truck code as currently resides on the library. See Notes.
Uniform Lane Load	Enter the uniform load per foot equivalent to one wheel line. This would be the usual lane load divided by 2. Use kips/foot.
Concentrated Load for Shear	Enter the concentrated load for shear equivalent to one wheel line. This would be the usual value divided by 2. Use kips.
Concentrated Load for Moment	Enter the concentrated load for moment equivalent to one wheel line. This would be the usual value divided by 2. Use kips.
Truck Weight (Required)	Enter the total weight of the truck in tons. This will be used in the rating report.

EXAMPLE

To store an AASHTO HS20 lane load on the "Truck Library", the command would be used as follows:

NEW-TRUCK-1 LANEHS20, 0.32, 13, 9, 36

FIGURES

NOTES

The truck code for an AASHTO HS type truck with variable axle spacing must begin with the letters HS. This is the signal to BRASS to vary the rear axle spacing from 14 feet to 30 feet by one foot increments.

Truck codes for AASHTO lane loads must begin with LANE.

See Note on page 15.1 for instructions to run the Truck/Sections Library update program.

1210	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	NEW-TRUCK-2	NT2
PURPOSE	This command is used to enter up to 40 characters to describe a truck stored in the "Truck Library".	

2 COMMAND PARAMETERS

Truck Code (Required)	Enter the truck code of the truck to which the following descriptive data will apply.
Description	Enter up to forty characters to describe the truck.

EXAMPLE

To describe an AASHTO HS20 lane load, the command could be used as follows:

NEW-TRUCK-2 LANEHS20, AASHTO LANE LOAD FOR HS20 TRUCK

FIGURES

NOTES

1220	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	NEW-TRUCK-3	NT3
PURPOSE	This command describes the wheel weights and spacings of a truck to be added to the "Truck Library" or to update an existing truck in the library. To update, enter the truck code and the parameter(s) that are to be changed. Repeat as often as needed.	

4 COMMAND PARAMETERS

Truck Code (Required)	Up to 12 alpha numeric characters to identify the truck to be described by the following parameters. If updating an existing entry be sure to use exactly the same truck code as currently resides in the library.
Wheel Number	Enter the wheel number to be described by the following two parameters - count wheel number beginning at the front of the truck.
Wheel Weight	Enter the weight of the wheel in kips.
Spacing to Wheel # + 1	Enter the distance in feet from this wheel # to the wheel # + 1. If this is the last wheel number, enter 0 or leave blank.

EXAMPLE

To describe an AASHTO HS20 truck, the command would be used as follows:

```
NEW-TRUCK-3    HS20T, 1,    4,      14
NEW-TRUCK-3    HS20T, 2,    16,     14.0
NEW-TRUCK-3    HS20T, 3,    16,      0.0
```

To describe a Wyoming type 3 truck (see Figure 1) the command would be used as follows:

```
NEW-TRUCK-3    WYO TYPE3,1,    4,      15.0
NEW-TRUCK-3    WYO TYPE3,2,    9,       4.0
NEW-TRUCK-3    WYO TYPE3,3,    9,       0.0
```

FIGURES

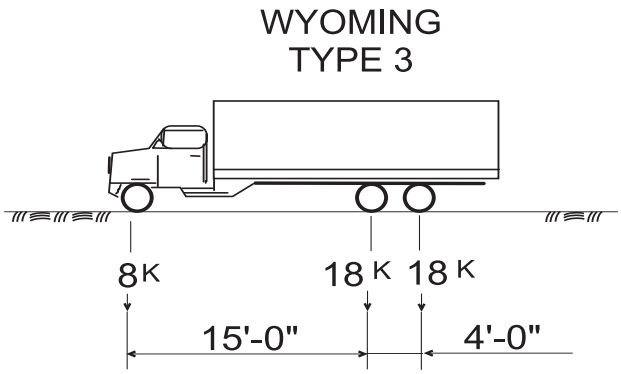


Figure 1

NOTES

1230	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DELETE-TRUCK	DTK
PURPOSE	This command allows the user to delete trucks from the "Truck Library". This command may be repeated if more than 6 trucks are to be deleted.	

6 COMMAND PARAMETERS	
Truck Code	Enter the truck code of the first truck to be deleted.
Truck Code	Enter the truck code of the second truck to be deleted.
Truck Code	Enter the truck code of the third truck to be deleted.
Truck Code	Enter the truck code of the fourth truck to be deleted.
Truck Code	Enter the truck code of the fifth truck to be deleted.
Truck Code	Enter the truck code of the sixth truck to be deleted.

EXAMPLE

To delete the truck whose code is WYOTYPE 3 the command would be used as follows:

DELETE-TRUCK WYOTYPE 3

FIGURES

NOTES

See Note on page 15.1 for instructions to run the Truck/Sections Library update program.

1240	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PRINT-TRUCK	PTK
PURPOSE	This command is used to print all or part of the "Truck Library".	

6 COMMAND PARAMETERS

Truck Code	Enter the truck code of the first truck for which data is to be printed. This parameter may be used to control the printing of either a summary listing or a complete listing of the "Truck Library". For summary listing, enter LIST. For complete listing, enter DUMP.
Truck Code	Enter the truck code of the second truck for which data is to be printed.
Truck Code	Enter the truck code of the third truck for which data is to be printed.
Truck Code	Enter the truck code of the fourth truck for which data is to be printed.
Truck Code	Enter the truck code of the fifth truck for which data is to be printed.
Truck Code	Enter the truck code of the sixth truck for which data is to be printed.

EXAMPLE

To print the entire "Truck Library" the command would be used as follows:

PRINT-TRUCK DUMP

To print the axle weight and spacing data for several trucks in the "Truck Library" the command would be used as follows:

PRINT-TRUCK HS20T, WYOTYPE3

FIGURES

NOTES

See Note on page 15.1 for instructions to run the Truck/Sections Library update program.

1250	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	NEW-SECT-1	NS1
PURPOSE	This is the first in a series of eight required commands used to add a standard girder cross section to the "Standard Sections Library" or update an existing standard girder cross section in the "Standard Sections Library." To update a cross section property, enter the Section Code and the parameter to be changed. If no parameters are to be changed, the command may be omitted.	

6 COMMAND PARAMETERS	
Section Code (Required)	Enter up to 12 alpha numeric characters to identify the girder cross section to be described by the following parameters. When adding a new section, *ensure the Section Code does not already exist in the library*. If updating an existing entry, be sure to use exactly the same Section Code as currently resides in the library. See Note 1.
Nominal Depth	If this is an AISC standard rolled shape or an AASHTO PCI girder, enter the nominal depth of the section, in inches. This depth is not used in calculations, only as an identifier.
Weight Per Foot	Enter the weight per lineal foot, in pounds, of the section.
Area	Enter the cross-sectional area, in square inches, of the *girder* section (flanges, web, fillets, and tapers only). Enter 0.0 or blank if you want BRASS-GIRDER™ to calculate the area. See Notes 2 and 3.
Actual Depth	Enter the actual total depth of the section, in inches.
Top Flange Width	Enter the width of the top flange, in inches.

EXAMPLE

See Page 15.32

FIGURES

NOTES

1. In the standard sections library, some standard shapes begin with "W" and "WN" (i.e., W24X76 and WN24X76). In 1985, AISC changed the dimensions of several steel shapes while keeping the same designation. To differentiate between the two types (especially when the older shape is needed to perform a rating) an "N" was added to the shape designation to indicate a NEW shape.

2. If a zero or blank is entered for the area, BRASS-GIRDER™ will compute the *girder* area, *girder* moment of inertia about the x axis, and the distance from the *bottom of the bottom flange* to the *girder* centroid. These results will be stored internally in BRASS-GIRDER™ prior to analysis. These results will not be added to the library itself. NOTE: If you want BRASS-GIRDER™ to compute the girder area, you must also enter a zero or blank for moment of inertia about the x axis (NEW-SECT-3 command, parameter 3), and distance from the bottom of the bottom flange to the girder centroid (NEW-SECT-5 command, parameter 3).

3. During analysis BRASS-GIRDER™ will compute the *total* area (girder plus cover plates), *total* moment of inertia about the x axis, and the *total* distance from the *bottom of the bottom cover plate* to the centroid using: 1) The girder section properties and dimensions entered in the library; 2) The girder section properties computed by BRASS (see Note 2 above); and 3) User defined dimensions entered in the XSECT-x commands (see Note 3 on page 9.13). The combined girder and cover plate results will be shown in the BRASS-GIRDER™ analysis output file for the standard section. If an effective concrete flange is coded in the XSECT-C or is entered in the standard section library, it will not be applied until Stage 2.

1260	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	NEW-SECT-2	NS2
PURPOSE	This is the second in a series of eight required commands used to add a standard girder cross section to the "Standard Sections Library" or update an existing standard girder cross section in the "Standard Sections Library." To update a cross section property, enter the Section Code and the parameter to be changed. If no parameters are to be changed, the command may be omitted.	

6 COMMAND PARAMETERS	
Section Code (Required)	Enter up to 12 alpha numeric characters to identify the girder cross section to be described by the following parameters. If updating an existing entry be sure to use exactly the same Section Code as currently resides in the library.
Bottom Flange Width	Enter the width of the bottom flange in inches.
Top Flange Thickness	Enter the thickness of the top flange in inches.
Bottom Flange Thickness	Enter the thickness of the bottom flange in inches.
Top Web Width	Enter the web width at the top of the web in inches.
Bottom Web Width	Enter the web width at the bottom of the web in inches.

EXAMPLE

See Page 15.32

FIGURES

NOTES

1270	BRASS-GIRDER™	COMMAND DESCRIPTION

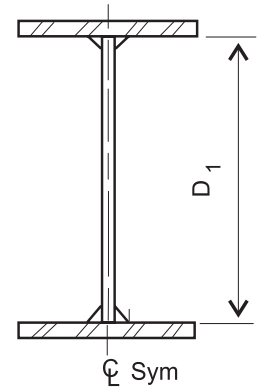
COMMAND NAME	NEW-SECT-3	NS3
PURPOSE	This is the third in a series of eight required commands used to add a standard girder cross section to the "Standard Sections Library" or update an existing standard girder cross section in the "Standard Sections Library." To update a cross section property, enter the Section Code and the parameter to be changed. If no parameters are to be changed, the command may be omitted.	

6 COMMAND PARAMETERS	
Section Code (Required)	Enter up to 12 alpha numeric characters to identify the girder cross section to be described by the following parameters. If updating an existing entry be sure to use exactly the same Section Code as currently resides in the library.
Web Depth	Enter the depth of the web between flanges in inches. See Figures.
Moment of inertia x axis	Enter the moment of inertia about the x axis, in inches^4, of the girder section (including flanges, web, tapers, and fillets). Enter 0.0 or blank if you want BRASS- Girder to compute this value. Important: See Notes 1 and 2.
Moment of inertia y axis	Enter the moment of inertia about the y axis, in inches^4, of the girder section (including flanges, web, tapers, and fillets). See Note 3.
Z Plastic Modulus y axis	Enter the plastic modulus in, inches^3, about the y axis. If you want BRASS-GIRDER™ to compute the plastic modulus, leave this parameter blank.
Z Plastic Modulus x axis	Enter the plastic modulus, in inches^3, about the x axis. If you want BRASS-GIRDER™ to compute the plastic modulus, leave this parameter blank.

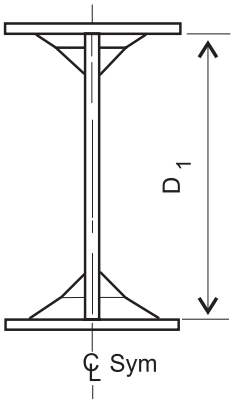
EXAMPLE

See Page 15.32

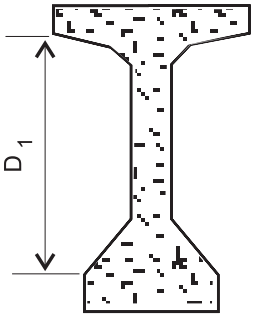
FIGURES



Welded Plate Girder



Girder with Fillets and Tapers



Precast Concrete Girder

NOTES

1. If a zero or blank is entered for the area (NEW-SECT-1 command, parameter 4), BRASS-GIRDER™ will compute the *girder* area, *girder* moment of inertia about the x axis, and the distance from the *bottom of the bottom flange* to the *girder* centroid. These results will be stored internally in BRASS-GIRDER™ prior to analysis. These results will not be added to the library itself. NOTE: If you want BRASS-GIRDER™ to compute the girder moment of inertia about the x axis, you must also enter a zero or blank for area (NEW-SECT-1 command, parameter 4), and distance from the bottom of the bottom flange to the girder centroid (NEW-SECT-5 command, parameter 3).

2. During analysis BRASS-GIRDER™ will compute the *total* area (girder plus cover plates), *total* moment of inertia about the x axis, and the *total* distance from the *bottom of the bottom cover plate* to the centroid using: 1) The girder section properties and dimensions entered in the library; 2) The girder section properties computed by BRASS (see Note 1 above); and 3) User defined dimensions entered in the XSECT-x commands (see Note 3 on page 9.13). The combined girder and cover plate results will be shown in the BRASS-GIRDER™ analysis output file for the standard section. If an effective concrete flange is coded in the XSECT-C or is entered in the standard section library, it will not be applied until Stage 2.

3. BRASS-GIRDER™ will not compute the moment of inertia about the y axis based on library values. The user must input this value.

1280	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	NEW-SECT-4	NS4
PURPOSE	This is the fourth in a series of eight required commands used to add a standard girder cross section to the "Standard Sections Library" or update an existing standard girder cross section in the "Standard Sections Library." To update a cross section property, enter the Section Code and the parameter to be changed. If no parameters are to be changed, the command may be omitted.	

6 COMMAND PARAMETERS	
Section Code (Required)	Enter up to 12 alpha numeric characters to identify the girder cross section to be described by the following parameters. If updating an existing entry be sure to use exactly the same Section Code as currently resides in the library.
Top Cover Plate Width	Enter the width of the top cover plate or composite slab in inches. See Notes.
Bottom Cover Plate Width	Enter the width of the bottom cover plate in inches. See Notes.
Top Cover Plate Thickness	Enter the thickness of the top cover plate on composite slab in inches. See Notes.
Bottom Cover Plate Thickness	Enter the thickness of the bottom cover plate in inches. See Notes.
Top Cover Plate Clearance	Enter the vertical clearance between the top of the top flange and the bottom of the top cover plate or composite slab in inches.

EXAMPLE

See Page 15.32

FIGURES

NOTES

1. If a standard section has an effective concrete flange, a top cover plate, or a bottom cover plate *as part of the section defined in the standard sections library*, parameters 1, 2, 4, and/or 5 of the XSECT-C command will not override the library values.

2. During analysis BRASS-GIRDER™ will compute the *total* area (girder plus cover plates), *total* moment of inertia about the x axis, and the *total* distance from the *bottom of the bottom cover plate* to the centroid using: 1) The girder section properties and dimensions entered in the library; 2) The girder section properties computed by BRASS (see Note 1, page 15.21); and 3) User defined dimensions entered in the XSECT-x commands (see Note 3 on page 9.13). The combined girder and cover plate results will be shown in the BRASS-GIRDER™ analysis output file for the standard section. If an effective concrete flange is coded in the XSECT-C or is entered in the standard section library, it will not be applied until Stage 2.

1290	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	NEW-SECT-5	NS5
PURPOSE	This is the fifth in a series of eight required commands used to add a standard girder cross section to the "Standard Sections Library" or update an existing standard girder cross section in the "Standard Sections Library." To update a cross section property, enter the Section Code and the parameter to be changed. If no parameters are to be changed, the command may be omitted.	

6 COMMAND PARAMETERS	
Section Code (Required)	Enter up to 12 alpha numeric characters to identify the girder cross section to be described by the following parameters. If updating an existing entry be sure to use exactly the same Section Code as currently resides in the library.
Bottom Cover	Enter the vertical clearance between the top of the bottom cover plate and the bottom of the bottom flange in inches.
y-Bar	Enter the vertical distance from the bottom of the bottom flange to the x-x neutral axis of the girder section, in inches. See Notes.
F1	Enter the taper dimension F1 in inches. See Figure 2.
F2	Enter the taper dimension F2 in inches. See Figure 2.
F3	Enter the fillet dimension F3 in inches. See Figures 1 and 2.

EXAMPLE

See Page 15.32

FIGURES

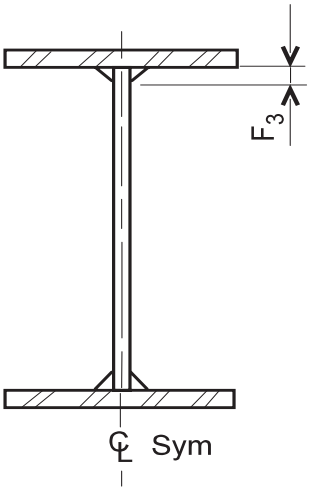


Figure 1

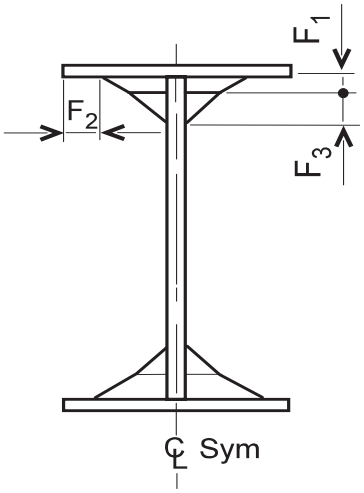


Figure 2

NOTES

1. If a zero or blank is entered for the area (NEW-SECT-1 command, parameter 4), BRASS-GIRDER™ will compute the *girder* area, *girder* moment of inertia about the x axis, and the distance from the *bottom of the bottom flange* to the *girder* centroid. These results will be stored internally in BRASS-GIRDER™ prior to analysis. These results will not be added to the library itself. NOTE: If you want BRASS-GIRDER™ to compute the distance from the bottom of the bottom flange to the girder centroid, you must also enter a zero or blank for area (NEW-SECT-1 command, parameter 4), and girder moment of inertia about the x axis (NEW-SECT-3 command, parameter 3).

2. During analysis BRASS-GIRDER™ will compute the *total* area (girder plus cover plates), *total* moment of inertia about the x axis, and the *total* distance from the *bottom of the bottom cover plate* to the centroid using: 1) The girder section properties and dimensions entered in the library; 2) The girder section properties computed by BRASS (see Note 1 above); and 3) User defined dimensions entered in the XSECT-x commands (see Note 3 on page 9.13). The combined girder and cover plate results will be shown in the BRASS-GIRDER™ analysis output file for the standard section. If an effective concrete flange is coded in the XSECT-C or is entered in the standard section library, it will not be applied until Stage 2.

1300	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	NEW-SECT-6	NS6
PURPOSE	This is the sixth in a series of eight required commands used to add a standard girder cross section to the "Standard Sections Library" or update an existing standard girder cross section in the "Standard Sections Library." To update a cross section property, enter the Section Code and the parameter to be changed. If no parameters are to be changed, the command may be omitted.	

6 COMMAND PARAMETERS	
Section Code (Required)	Enter up to 12 alpha numeric characters to identify the girder cross section to be described by the following parameters. If updating an existing entry be sure to use exactly the same Section Code as currently resides in the library.
F4	Enter the fillet dimension F4 in inches. See Figures 1 and 2.
F5	Enter the taper dimension F5 in inches. See Figure 2.
F6	Enter the taper dimension F6 in inches. See Figure 2.
F7	Enter the fillet dimension F7 in inches. See Figures 1 and 2.
F8	Enter the fillet dimension F8 in inches. See Figures 1 and 2.

EXAMPLE

See Page 15.32

FIGURES

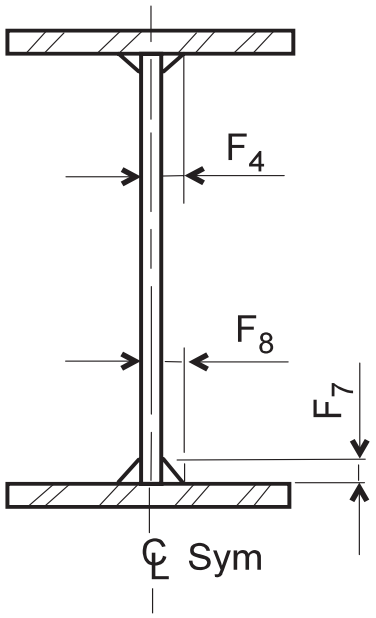


Figure 1

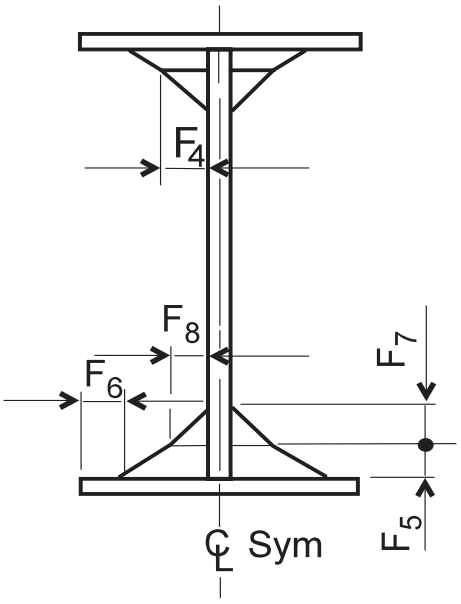


Figure 2

NOTES

1310	BRASS-GIRDER™	COMMAND DESCRIPTION

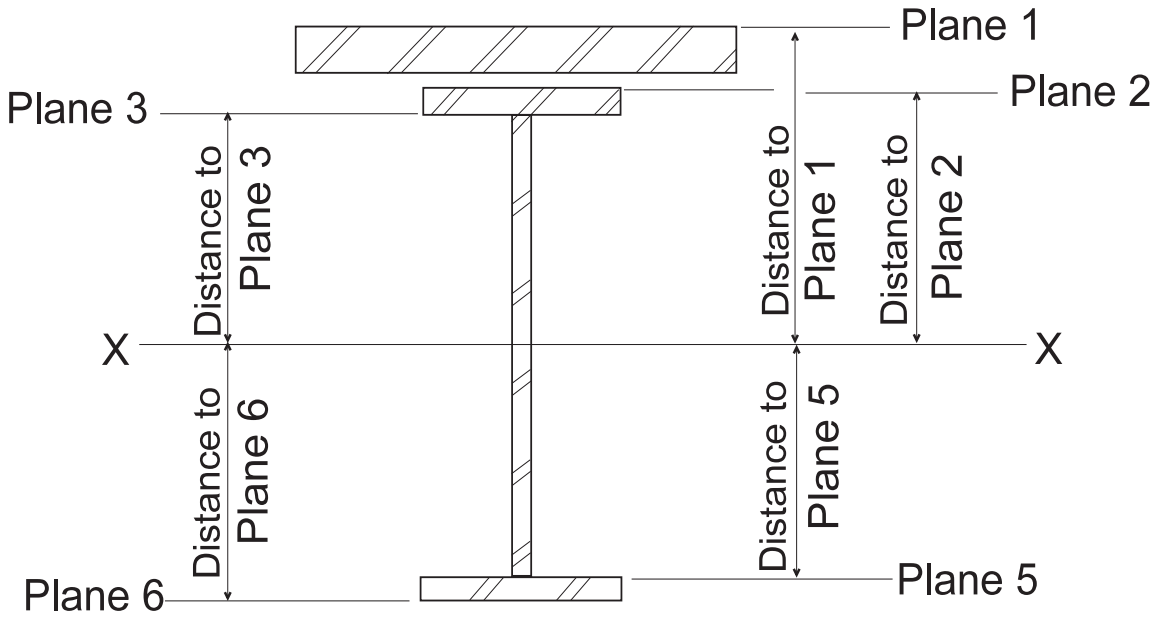
COMMAND NAME	NEW-SECT-7	NS7
PURPOSE	This is the seventh in a series of eight required commands used to add a standard girder cross section to the "Standard Sections Library" or update an existing standard girder cross section in the "Standard Sections Library." To update a cross section property, enter the Section Code and the parameter to be changed. If no parameters are to be changed, the command may be omitted.	

6 COMMAND PARAMETERS	
Section Code (Required)	Enter up to 12 alpha numeric characters to identify the girder cross section to be described by the following parameters. If updating an existing entry be sure to use exactly the same Section Code as currently resides in the library.
Distance to Plane 1	Enter the distance from the x-x neutral axis to analysis plane #1 in inches. See Figure 1.
Distance to Plane 2	Enter the distance from the x-x neutral axis to analysis plane #2 in inches. See Figure 1.
Distance to Plane 3	Enter the distance from the x-x neutral axis to analysis plane #3 in inches. See Figure 1.
Distance to Plane 5	Enter the distance from the x-x neutral axis to analysis plane #5 in inches. See Figure 1.
Distance to Plane 6	Enter the distance from the x-x neutral axis to analysis plane #6 in inches. See Figure 1.

EXAMPLE

See Page 15.32

FIGURES



NOTES

Analysis planes may be designated as desired by the user. In general, stresses will be calculated at the analysis planes by $f = \frac{Mc}{I}$ where c is the distance from the analysis plane to the centroid.

1320	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	NEW-SECT-8	NS8
PURPOSE	This is the eighth in a series of eight required commands used to add a standard girder cross section to the "Standard Sections Library" or update an existing standard girder cross section in the "Standard Sections Library." To update a cross section property, enter the Section Code and the parameter to be changed. If no parameters are to be changed, the command may be omitted.	

3 COMMAND PARAMETERS	
Section Code (Required)	Enter up to 12 alpha numeric characters to identify the girder cross section to be described by the following parameters. If updating an existing entry be sure to use exactly the same Section Code as currently resides in the library.
Distance to Plane #7	Enter the distance from the x-x neutral axis to analysis plane #7 in inches. See Figure 1.
Cross Section Description	Enter up to forty characters used to describe the cross section.

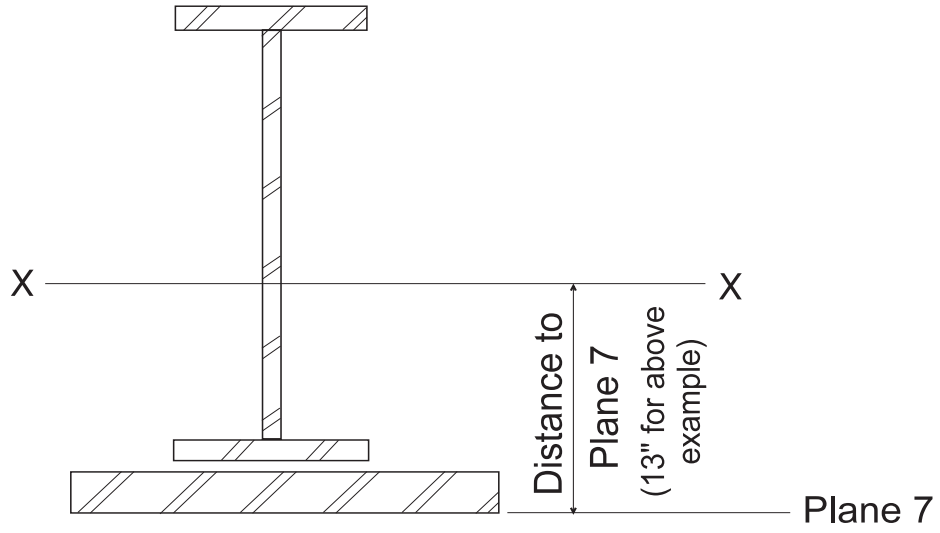
EXAMPLE

To describe a typical cross section, the command would be used as follows:

NEW-SECT-8 EXAMPLE, 13, WYOMING STANDARD NO. 1625N

Also See Page 15.32

FIGURES



NOTES

EXAMPLE

For the example typical section shown below in Figure 1, the NEW-SECT-# series would be used as follows:

NEW-SECT-1	EXAMPLE,	,	,	42.13,	24,	10
NEW-SECT-2	EXAMPLE,	10,	1,	1,	1,	1
NEW-SECT-3	EXAMPLE,	22,	3548.90,	168.50,	,	
NEW-SECT-4	EXAMPLE,	22,	22,	2,	2,	1
NEW-SECT-5	EXAMPLE,	1,	12,	,	,	.25
NEW-SECT-6	EXAMPLE,	.25,	,	,	.25,	.25
NEW-SECT-7	EXAMPLE,	15,	12,	11,	11,	12
NEW-SECT-8	EXAMPLE,	15,	EXAMPLE SECTION FOR USER MANUAL			

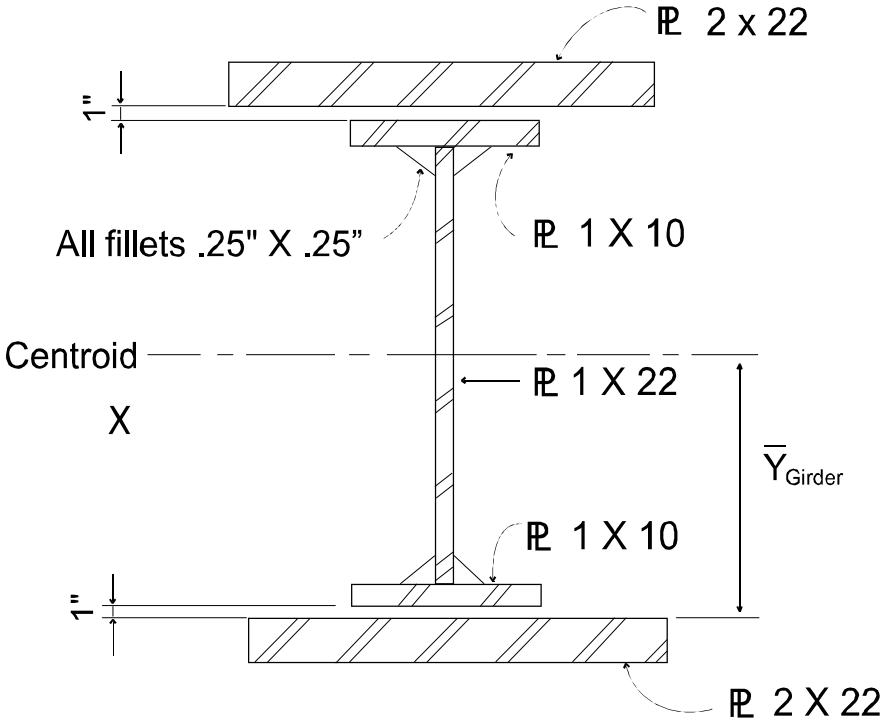


Figure 1 - Example Steel Section

See Note on page 15.1 for instructions to run the Truck/Sections Library update program.

1330	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	DELETE-SECT	DSC
PURPOSE	This command is used to delete sections from the "Standard Shapes Library". This command may be repeated if more than 6 sections are to be deleted.	

6 COMMAND PARAMETERS	
Section Code	Enter the section code of the first set of cross section data to be deleted from the "Standard Shapes Library".
Section Code	Enter the section code of the second set of cross section data to be deleted from the "Standard Shapes Library".
Section Code	Enter the section code of the third set of cross section data to be deleted from the "Standard Shapes Library".
Section Code	Enter the section code of the fourth set of cross section data to be deleted from the "Standard Shapes Library".
Section Code	Enter the section code of the fifth set of cross section data to be deleted from the "Standard Shapes Library".
Section Code	Enter the section code of the sixth set of cross section data to be deleted from the "Standard Shapes Library".

EXAMPLE

To delete the data for the typical cross section named EXAMPLE, the command would be utilized as follows:

DELETE-SECT EXAMPLE

FIGURES

NOTES

See Note on page 15.1 for instructions to run the Truck/Section Library update program.

1340	BRASS-GIRDER™	COMMAND DESCRIPTION

COMMAND NAME	PRINT-SECT	PSC
PURPOSE	This command is used to print all or part of the "Standard Shapes Library". This command may be repeated if necessary. To print the entire library, leave all six parameters blank.	

6 COMMAND PARAMETERS	
Section Code	Enter the section code of the first set of typical cross section data to be printed. See Notes. This parameter may be used to control the printing of either a summary listing or a complete listing of the "Standard Shapes Library". For summary listing, enter LIST. For complete listing, enter DUMP.
Section Code	Enter the section code of the second set of typical cross section data to be printed. See Notes.
Section Code	Enter the section code of the third set of typical cross section data to be printed. See Notes.
Section Code	Enter the section code of the fourth set of typical cross section data to be printed. See Notes.
Section Code	Enter the section code of the fifth set of typical cross section data to be printed. See Notes.
Section Code	Enter the section code of the sixth set of typical cross section data to be printed. See Notes.

EXAMPLE

To print the data for the cross section code EXAMPLE, the command would be utilized as follows:

PRINT-SECTEXAMPLE

FIGURES

NOTES

The output file created by this command is simply an echo of the user defined standard section library values. The area, moment of inertia, and the distance to the centroid of the section are relative to the girder section composed of the flanges, web, fillets, and tapers. It does not include the section properties of the cover plates or effective concrete slab. For this reason, the values in this output file may not equal the values in the BRASS-GIRDER™ analysis output which includes the combination of the section properties of the girder with the section properties of the cover plates and/or an effective flange (depending on the stage).

See Note on page 15.1 for instructions to run the Truck/Sections Library update program.

Contents of Truck Library - truck.lby

TRUCK CODE:	HS25T	AASHTO HS25-44 (MS 22.5) TRUCK
TRUCK CODE:	LANEHS25	AASHTO HS25-44 (MS 22.5) LANE
TRUCK CODE:	HS20T	AASHTO HS20-44 (MS 18) TRUCK
TRUCK CODE:	LANEHS20	AASHTO HS20-44 (MS 18) LANE
TRUCK CODE:	HS15T	AASHTO HS15-44 (MS 13.5) TRUCK
TRUCK CODE:	LANEHS15	AASHTO HS15-44 (MS 13.5) LANE
TRUCK CODE:	H20T	AASHTO H20-44 (M 18) TRUCK
TRUCK CODE:	H15T	AASHTO H15-44 (M 13.5) TRUCK
TRUCK CODE:	H10T	AASHTO H10 TRUCK
TRUCK CODE:	MILITARY	AASHTO ALTERNATE MILITARY LOADING
TRUCK CODE:	TYPE3	AASHTO TYPE 3 RATING TRUCK
TRUCK CODE:	TYPE3S2	AASHTO TYPE 3S2 RATING TRUCK
TRUCK CODE:	TYPE3-3	AASHTO TYPE 3-3 RATING TRUCK
TRUCK CODE:	TRIPLE	WYOMING TRIPLE RATING TRUCK
TRUCK CODE:	SINGLE	WYO CONSTRUCTION SINGLE (SCRAPER)
TRUCK CODE:	LANEH20	H20-44 AASHTO LANE LOAD
TRUCK CODE:	LANEH15	H15-44 AASHTO LANE LOAD
TRUCK CODE:	MX	AIR FORCE MX MISSLE CARRIER
TRUCK CODE:	MXC	AIR FORCE MX MISSLE CANISTER
TRUCK CODE:	T1	OVERLOAD TRUCK 1
TRUCK CODE:	T2	OVERLOAD TRUCK 2
TRUCK CODE:	T3	OVERLOAD TRUCK 3
TRUCK CODE:	T4	OVERLOAD TRUCK 4
TRUCK CODE:	T5	OVERLOAD TRUCK 5
TRUCK CODE:	T6	OVERLOAD TRUCK 6
TRUCK CODE:	T7	OVERLOAD TRUCK 7
TRUCK CODE:	T8	OVERLOAD TRUCK 8
TRUCK CODE:	T9	OVERLOAD TRUCK 9
TRUCK CODE:	T10	OVERLOAD TRUCK 10
TRUCK CODE:	T11	OVERLOAD TRUCK 11
TRUCK CODE:	T12	OVERLOAD TRUCK 12
TRUCK CODE:	T13	OVERLOAD TRUCK 13
TRUCK CODE:	T9A	97.5 T TRUCK
TRUCK CODE:	T10A	100.5 T TRUCK
TRUCK CODE:	T11A	110.5 T TRUCK
TRUCK CODE:	T12A	121.5 T TRUCK
TRUCK CODE:	T13A	124.5 T TRUCK
TRUCK CODE:	T1B	TRUCK T1B - 50T
TRUCK CODE:	T2B	TRUCK T2B - 53T
TRUCK CODE:	T3B	TRUCK T3B - 65T
TRUCK CODE:	T4B	TRUCK T4B - 57.5T
TRUCK CODE:	T5B	TRUCK T5B - 66.5T
TRUCK CODE:	T6B	TRUCK T6B - 63.5T
TRUCK CODE:	T7B	TRUCK T7B - 69.5T
TRUCK CODE:	T8B	TRUCK T8B - 68T
TRUCK CODE:	T9B	TRUCK T9B - 89T
TRUCK CODE:	T10B	TRUCK - 92T
TRUCK CODE:	T11B	TRUCK T11B - 102.5T
TRUCK CODE:	T12B	TRUCK T12B - 114.5T
TRUCK CODE:	T13B	TRUCK T13B - 117.5T
TRUCK CODE:	CR1	151 TON OVERLOAD TRUCK
TRUCK CODE:	GETT1	DOUBLE-WIDE OVERLOAD
TRUCK CODE:	GETT2	SINGLE-WIDE OVERLOAD
TRUCK CODE:	MASH608	MASHBURN OVERLOAD TRUCK 2 LANES WIDE
TRUCK CODE:	MASH610	MASHBURN OVERLOAD TRUCK 2 LANES WIDE
TRUCK CODE:	F3	OVERLOAD TRUCK FORMULA DEVELOPMENT
TRUCK CODE:	F1	OVERLOAD TRUCK FORMULA DEVELOPMENT
TRUCK CODE:	F4	OVERLOAD TRUCK FORMULA DEVELOPMENT
TRUCK CODE:	F2	OVERLOAD TRUCK FORMULA DEVELOPMENT
TRUCK CODE:	MODTYPE3-3	141 KIP LONGER COMBINATION VEHICLE
TRUCK CODE:	ATA2	SHORT TRAILER 3S2 82K GVW.
TRUCK CODE:	ATA1	0.000 0.000 0.000 0.000 0.000 0.0
TRUCK CODE:	ATA3	TRI-AXLE 6 AXLE 92K GVW
TRUCK CODE:	ATA4	STAA DOUBLE 5 AXLE 92K GVW
TRUCK CODE:	ATA5	ROCKY MOUNT DOUBLE 7 AXLE 105K GVW
TRUCK CODE:	ATA6	WHI B TRAIN 9 AXLE 105K GVW
TRUCK CODE:	ATA7	SHT TURNPIKE DBL 9 AXLE 105K GVW
TRUCK CODE:	ATA8	WHI TRIPLE TRAILER 7 AXLE 115K GVW
TRUCK CODE:	ATA9	TURNPIKE DOUBLE 9 AXLE 115K GVW
TRUCK CODE:	ATA10	TURNPIKE DOUBLE 9 AXLE 130K GVW
TRUCK CODE:	JAKES	14 FT WIDE WITH NARROW DOLLYS
TRUCK CODE:	PRESS1	EXCHANGER BOX
TRUCK CODE:	PRESS3	ABSORBER BOX
TRUCK CODE:	PRESS2	COLUMN BOX
TRUCK CODE:	PRESS1A	EXCHANGER BOX
TRUCK CODE:	PRESS2A	COLUMN BOX
TRUCK CODE:	CRANE	PAUL JOHNSON CRANE 5-18-89
TRUCK CODE:	TCLOSE	WYOMING TYPE PICKUP TRUCK
TRUCK CODE:	SAVAGE	OVERWGT LOAD FOR SAVAGE INDUSTRIES
TRUCK CODE:	PRESS3A1	ABSORBER BOX
TRUCK CODE:	PRESS3A2	ABSORBER BOX
TRUCK CODE:	F1MOD	OVERLD TRUCK FORMULA DEVELOPMENT
TRUCK CODE:	PRESS3A3	ABSORBER BOX

TRUCK CODE:	QUARRY1	OVERWEIGHT LOAD FOR GRANITE CANYON QUARRY
TRUCK CODE:	QUARRY2	OVERWEIGHT LOAD FOR GRANITE CANYON QUARRY
TRUCK CODE:	RANGER	OVERWEIGHT LOAD FOR RANGER TRANSPORT
TRUCK CODE:	RANGER1	OVERWEIGHT LOAD FOR RANGER1 TRANSPORT
TRUCK CODE:	RANGER2	OVERWEIGHT LOAD FOR RANGER2 TRANSPORT
TRUCK CODE:	RANGER3	OVERWEIGHT LOAD FOR RANGER3 TRANSPORT
TRUCK CODE:	RANGER4	OVERWEIGHT LOAD FOR RANGER4 TRANSPORT
TRUCK CODE:	RANGER5	OVERWEIGHT LOAD FOR RANGER5 TRANSPORT
TRUCK CODE:	RANGER6	OVERWEIGHT LOAD FOR RANGER6 TRANSPORT
TRUCK CODE;	RANGER7	OVERWEIGHT LOAD FOR RANGER7 TRANSPORT
TRUCK CODE:	P13	MAX CALIF PERMIT VEHICLE
TRUCK CODE:	WYOTYPE 3	WYOMING TYPE 3 RATING TRUCK
TRUCK CODE:	WYOTYPE 3S2	WYOMING TYPE 3S2 RATING TRUCK
TRUCK CODE:	WYOTYPE 3-3	WYOMING TYPE 3-3 RATING TRUCK

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SECTION CODE:	WN44X262	WIDE FLANGE	44X262
SECTION CODE:	WN44X230	WIDE FLANGE	44X230
SECTION CODE:	WN40X593	WIDE FLANGE	40X593
SECTION CODE:	WN40X503	WIDE FLANGE	40X503
SECTION CODE:	WN40X431	WIDE FLANGE	40X431
SECTION CODE:	WN40X372	WIDE FLANGE	40X372
SECTION CODE:	WN40X321	WIDE FLANGE	40X321
SECTION CODE:	WN40X297	WIDE FLANGE	40X297
SECTION CODE:	WN40X277	WIDE FLANGE	40X277
SECTION CODE:	WN40X249	WIDE FLANGE	40X249
SECTION CODE:	WN40X215	WIDE FLANGE	40X215
SECTION CODE:	WN40X199	WIDE FLANGE	40X199
SECTION CODE:	WN40X174	WIDE FLANGE	40X174
SECTION CODE:	WN40X466	WIDE FLANGE	40X466
SECTION CODE:	WN40X392	WIDE FLANGE	40X392
SECTION CODE:	WN40X331	WIDE FLANGE	40X331
SECTION CODE:	WN40X278	WIDE FLANGE	40X278
SECTION CODE:	WN40X264	WIDE FLANGE	40X264
SECTION CODE:	WN40X235	WIDE FLANGE	40X235
SECTION CODE:	WN40X211	WIDE FLANGE	40X211
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SECTION CODE:	W36X192	WIDE FLANGE	36X192
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SECTION CODE:	W33X260A	WIDE FLANGE	33X260A
SECTION CODE:	W33X260B	WIDE FLANGE	33X260B
SECTION CODE:	W33X245	WIDE FLANGE	33X245
SECTION CODE:	WN33X241	WIDE FLANGE	33X241
SECTION CODE:	W33X240A	WIDE FLANGE	33X240A
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SECTION CODE:	WN33X221	WIDE FLANGE	33X221
SECTION CODE:	W33X220A	WIDE FLANGE	33X220A
SECTION CODE:	W33X220B	WIDE FLANGE	33X220B
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SECTION CODE:	W33X202	WIDE FLANGE	33X202
SECTION CODE:	W33X200A	WIDE FLANGE	33X200A
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SECTION CODE:	WN33X118	WIDE FLANGE	33X118
SECTION CODE:	W30X240A	WIDE FLANGE	30X240A
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SECTION CODE:	W30X220B	WIDE FLANGE	30X220B	SECTION CODE:	W28X166	WIDE FLANGE	28X166
SECTION CODE:	WN30X211	WIDE FLANGE	30X211	SECTION CODE:	W28X165A	WIDE FLANGE	28X165A
SECTION CODE:	W30X210	WIDE FLANGE	30X210	SECTION CODE:	W28X165B	WIDE FLANGE	28X165B
SECTION CODE:	W30X200A	WIDE FLANGE	30X200A	SECTION CODE:	W28X156	WIDE FLANGE	28X156
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SECTION CODE:	WN30X191	WIDE FLANGE	30X191	SECTION CODE:	W28X133	WIDE FLANGE	28X133
SECTION CODE:	W30X190A	WIDE FLANGE	30X190A	SECTION CODE:	W28X119	WIDE FLANGE	28X119
SECTION CODE:	W30X190B	WIDE FLANGE	30X190B	SECTION CODE:	W28X113	WIDE FLANGE	28X113
SECTION CODE:	W30X181	WIDE FLANGE	30X181	SECTION CODE:	W28X112	WIDE FLANGE	28X112
SECTION CODE:	W30X180A	WIDE FLANGE	30X180A	SECTION CODE:	W28X106	WIDE FLANGE	28X106
SECTION CODE:	W30X180B	WIDE FLANGE	30X180B	SECTION CODE:	W28X105A	WIDE FLANGE	28X105A
SECTION CODE:	W30X180C	WIDE FLANGE	30X180C	SECTION CODE:	W28X105B	WIDE FLANGE	28X105B
SECTION CODE:	W30X175	WIDE FLANGE	30X175	SECTION CODE:	W28X104	WIDE FLANGE	28X104
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SECTION CODE:	W30X120A	WIDE FLANGE	30X120A	SECTION CODE:	WN27X114	WIDE FLANGE	27X114
SECTION CODE:	W30X120B	WIDE FLANGE	30X120B	SECTION CODE:	W27X112A	WIDE FLANGE	27X112A
SECTION CODE:	WN30X116	WIDE FLANGE	30X116	SECTION CODE:	W27X112B	WIDE FLANGE	27X112B
SECTION CODE:	W30X115A	WIDE FLANGE	30X115A	SECTION CODE:	W27X106	WIDE FLANGE	27X106
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SECTION CODE:	WN30X108	WIDE FLANGE	30X108	SECTION CODE:	W27X102	WIDE FLANGE	27X102
SECTION CODE:	WN30X99	WIDE FLANGE	30X99	SECTION CODE:	W27X98	WIDE FLANGE	27X98
SECTION CODE:	W28X186	WIDE FLANGE	28X186	SECTION CODE:	W27X97	WIDE FLANGE	27X97
SECTION CODE:	W28X180	WIDE FLANGE	28X180	SECTION CODE:	WN27X94	WIDE FLANGE	27X94

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SECTION CODE:	W27X91B	WIDE FLANGE	27X91B	SECTION CODE:	W24X120C	WIDE FLANGE	24X120C
SECTION CODE:	W27X91C	WIDE FLANGE	27X91C	SECTION CODE:	W24X120D	WIDE FLANGE	24X120D
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SECTION CODE:	W26X157	WIDE FLANGE	26X157	SECTION CODE:	W24X105A	WIDE FLANGE	24X105A
SECTION CODE:	W26X151	WIDE FLANGE	26X151	SECTION CODE:	W24X105B	WIDE FLANGE	24X105B
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SECTION CODE:	W26X144	WIDE FLANGE	26X144	SECTION CODE:	W24X100A	WIDE FLANGE	24X100A
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SECTION CODE:	W26X90A	WIDE FLANGE	26X90A	SECTION CODE:	W24X95A	WIDE FLANGE	24X95A
SECTION CODE:	W26X90B	WIDE FLANGE	26X90B	SECTION CODE:	W24X95B	WIDE FLANGE	24X95B
SECTION CODE:	W26X86A	WIDE FLANGE	26X86A	SECTION CODE:	W24X95C	WIDE FLANGE	24X95C
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SECTION CODE:	W24X160	WIDE FLANGE	24X160	SECTION CODE:	W24X90A	WIDE FLANGE	24X90A
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SECTION CODE:	WN24X146	WIDE FLANGE	24X146	SECTION CODE:	W24X85A	WIDE FLANGE	24X85A
SECTION CODE:	W24X145	WIDE FLANGE	24X145	SECTION CODE:	W24X85B	WIDE FLANGE	24X85B
SECTION CODE:	W24X141	WIDE FLANGE	24X141	SECTION CODE:	W24X85C	WIDE FLANGE	24X85C
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SECTION CODE:	W24X140B	WIDE FLANGE	24X140B	SECTION CODE:	W24X84A	WIDE FLANGE	24X84A
SECTION CODE:	W24X133	WIDE FLANGE	24X133	SECTION CODE:	W24X84B	WIDE FLANGE	24X84B
SECTION CODE:	W24X132	WIDE FLANGE	24X132	SECTION CODE:	WN24X84	WIDE FLANGE	24X84
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SECTION CODE:	W24X121	WIDE FLANGE	24X121	SECTION CODE:	W24X80B	WIDE FLANGE	24X80B
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SECTION CODE:	WN24X76	WIDE FLANGE	24X76	SECTION CODE:	W21X104	WIDE FLANGE	21X104
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SECTION CODE:	W24X74B	WIDE FLANGE	24X74B	SECTION CODE:	WN21X101	WIDE FLANGE	21X101
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SECTION CODE:	W24X70A	WIDE FLANGE	24X70A	SECTION CODE:	WN21X93	WIDE FLANGE	21X93
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SECTION CODE:	W22X108	WIDE FLANGE	22X108	SECTION CODE:	W21X75	WIDE FLANGE	21X75
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SECTION CODE:	W22X83	WIDE FLANGE	22X83	SECTION CODE:	W21X64	WIDE FLANGE	21X64
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SECTION CODE:	WN21X122	WIDE FLANGE	21X122	SECTION CODE:	W20X146	WIDE FLANGE	20X146
SECTION CODE:	W21X122	WIDE FLANGE	21X122	SECTION CODE:	W20X142	WIDE FLANGE	20X142
SECTION CODE:	W21X112	WIDE FLANGE	21X112	SECTION CODE:	W20X140	WIDE FLANGE	20X140

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SECTION CODE:	W20X85D	WIDE FLANGE	20X85D	SECTION CODE:	W18X99	WIDE FLANGE	18X99
SECTION CODE:	W20X82	WIDE FLANGE	20X82	SECTION CODE:	WN18X97	WIDE FLANGE	18X97
SECTION CODE:	W20X81A	WIDE FLANGE	20X81A	SECTION CODE:	W18X96	WIDE FLANGE	18X96
SECTION CODE:	W20X81B	WIDE FLANGE	20X81B	SECTION CODE:	W18X93A	WIDE FLANGE	18X93A
SECTION CODE:	W20X81C	WIDE FLANGE	20X81C	SECTION CODE:	W18X93B	WIDE FLANGE	18X93B
SECTION CODE:	W20X80A	WIDE FLANGE	20X80A	SECTION CODE:	W18X92A	WIDE FLANGE	18X92A
SECTION CODE:	W20X80B	WIDE FLANGE	20X80B	SECTION CODE:	W18X92B	WIDE FLANGE	18X92B
SECTION CODE:	W20X80C	WIDE FLANGE	20X80C	SECTION CODE:	W18X90A	WIDE FLANGE	18X90A
SECTION CODE:	W20X80D	WIDE FLANGE	20X80D	SECTION CODE:	W18X90B	WIDE FLANGE	18X90B
SECTION CODE:	W20X78A	WIDE FLANGE	20X78A	SECTION CODE:	W18X88	WIDE FLANGE	18X88
SECTION CODE:	W20X78B	WIDE FLANGE	20X78B	SECTION CODE:	WN18X86	WIDE FLANGE	18X86
SECTION CODE:	W20X75A	WIDE FLANGE	20X75A	SECTION CODE:	W18X86A	WIDE FLANGE	18X86A
SECTION CODE:	W20X75B	WIDE FLANGE	20X75B	SECTION CODE:	W18X86B	WIDE FLANGE	18X86B
SECTION CODE:	W20X75C	WIDE FLANGE	20X75C	SECTION CODE:	W18X85A	WIDE FLANGE	18X85A
SECTION CODE:	W20X74	WIDE FLANGE	20X74	SECTION CODE:	W18X85B	WIDE FLANGE	18X85B
SECTION CODE:	W20X73	WIDE FLANGE	20X73	SECTION CODE:	W18X85C	WIDE FLANGE	18X85C
SECTION CODE:	W20X72	WIDE FLANGE	20X72	SECTION CODE:	W18X81	WIDE FLANGE	18X81
SECTION CODE:	W20X70A	WIDE FLANGE	20X70A	SECTION CODE:	W18X80A	WIDE FLANGE	18X80A
SECTION CODE:	W20X70B	WIDE FLANGE	20X70B	SECTION CODE:	W18X80B	WIDE FLANGE	18X80B

SECTION CODE:	W18X80C	WIDE FLANGE	18X80C	SECTION CODE:	W18X46A	WIDE FLANGE	18X46A
SECTION CODE:	W18X80D	WIDE FLANGE	18X80D	SECTION CODE:	WN18X46	WIDE FLANGE	18X46
SECTION CODE:	W18X78	WIDE FLANGE	18X78	SECTION CODE:	W18X46B	WIDE FLANGE	18X46B
SECTION CODE:	W18X77	WIDE FLANGE	18X77	SECTION CODE:	W18X45	WIDE FLANGE	18X45
SECTION CODE:	WN18X76	WIDE FLANGE	18X76	SECTION CODE:	WN18X40	WIDE FLANGE	18X40
SECTION CODE:	W18X75A	WIDE FLANGE	18X75A	SECTION CODE:	WN18X35	WIDE FLANGE	18X35
SECTION CODE:	W18X75B	WIDE FLANGE	18X75B	SECTION CODE:	W16X115	WIDE FLANGE	16X115
SECTION CODE:	W18X75C	WIDE FLANGE	18X75C	SECTION CODE:	W16X114	WIDE FLANGE	16X114
SECTION CODE:	W18X75D	WIDE FLANGE	18X75D	SECTION CODE:	W16X107	WIDE FLANGE	16X107
SECTION CODE:	W18X75E	WIDE FLANGE	18X75E	SECTION CODE:	W16X105	WIDE FLANGE	16X105
SECTION CODE:	W18X74	WIDE FLANGE	18X74	SECTION CODE:	WN16X100	WIDE FLANGE	16X100
SECTION CODE:	W18X72	WIDE FLANGE	18X72	SECTION CODE:	W16X100	WIDE FLANGE	16X100
SECTION CODE:	WN18X71	WIDE FLANGE	18X71	SECTION CODE:	W16X96	WIDE FLANGE	16X96
SECTION CODE:	W18X70A	WIDE FLANGE	18X70A	SECTION CODE:	W16X90A	WIDE FLANGE	16X90A
SECTION CODE:	W18X70B	WIDE FLANGE	18X70B	SECTION CODE:	W16X90B	WIDE FLANGE	16X90B
SECTION CODE:	W18X70C	WIDE FLANGE	18X70C	SECTION CODE:	WN16X89	WIDE FLANGE	16X89
SECTION CODE:	W18X69	WIDE FLANGE	18X69	SECTION CODE:	W16X88	WIDE FLANGE	16X88
SECTION CODE:	W18X67A	WIDE FLANGE	18X67A	SECTION CODE:	W16X87	WIDE FLANGE	16X87
SECTION CODE:	W18X67B	WIDE FLANGE	18X67B	SECTION CODE:	W16X83A	WIDE FLANGE	16X83A
SECTION CODE:	WN18X65	WIDE FLANGE	18X65	SECTION CODE:	W16X83B	WIDE FLANGE	16X83B
SECTION CODE:	W18X65A	WIDE FLANGE	18X65A	SECTION CODE:	W16X81	WIDE FLANGE	16X81
SECTION CODE:	W18X65B	WIDE FLANGE	18X65B	SECTION CODE:	W16X78	WIDE FLANGE	16X78
SECTION CODE:	W18X64	WIDE FLANGE	18X64	SECTION CODE:	WN16X77	WIDE FLANGE	16X77
SECTION CODE:	WN18X60	WIDE FLANGE	18X60	SECTION CODE:	W16X76A	WIDE FLANGE	16X76A
SECTION CODE:	W18X60	WIDE FLANGE	18X60	SECTION CODE:	W16X76B	WIDE FLANGE	16X76B
SECTION CODE:	W18X59A	WIDE FLANGE	18X59A	SECTION CODE:	W16X75	WIDE FLANGE	16X75
SECTION CODE:	W18X59B	WIDE FLANGE	18X59B	SECTION CODE:	W16X72	WIDE FLANGE	16X72
SECTION CODE:	W18X58	WIDE FLANGE	18X58	SECTION CODE:	W16X71	WIDE FLANGE	16X71
SECTION CODE:	W18X57	WIDE FLANGE	18X57	SECTION CODE:	W16X68	WIDE FLANGE	16X68
SECTION CODE:	WN18X55	WIDE FLANGE	18X55	SECTION CODE:	WN16X67	WIDE FLANGE	16X67
SECTION CODE:	W18X55	WIDE FLANGE	18X55	SECTION CODE:	W16X66	WIDE FLANGE	16X66
SECTION CODE:	W18X54A	WIDE FLANGE	18X54A	SECTION CODE:	W16X64	WIDE FLANGE	16X64
SECTION CODE:	W18X54B	WIDE FLANGE	18X54B	SECTION CODE:	W16X63	WIDE FLANGE	16X63
SECTION CODE:	W18X53	WIDE FLANGE	18X53	SECTION CODE:	W16X61	WIDE FLANGE	16X61
SECTION CODE:	W18X52	WIDE FLANGE	18X52	SECTION CODE:	W16X58A	WIDE FLANGE	16X58A
SECTION CODE:	W18X51	WIDE FLANGE	18X51	SECTION CODE:	W16X58B	WIDE FLANGE	16X58B
SECTION CODE:	WN18X50	WIDE FLANGE	18X50	SECTION CODE:	WN16X57	WIDE FLANGE	16X57
SECTION CODE:	W18X49A	WIDE FLANGE	18X49A	SECTION CODE:	W16X57	WIDE FLANGE	16X57
SECTION CODE:	W18X49B	WIDE FLANGE	18X49B	SECTION CODE:	WN16X50	WIDE FLANGE	16X50
SECTION CODE:	W18X48A	WIDE FLANGE	18X48A	SECTION CODE:	W16X50	WIDE FLANGE	16X50
SECTION CODE:	W18X48B	WIDE FLANGE	18X48B	SECTION CODE:	WN16X45	WIDE FLANGE	16X45
SECTION CODE:	W18X47	WIDE FLANGE	18X47	SECTION CODE:	W16X45	WIDE FLANGE	16X45
SECTION CODE:	W18X47X	W18 taken from AISC 1940		SECTION CODE:	W16X43	WIDE FLANGE	16X43

SECTION CODE:	W16X40	WIDE FLANGE	16X40	SECTION CODE:	W15X71	WIDE FLANGE	15X71
SECTION CODE:	WN16X40	WIDE FLANGE	16X40	SECTION CODE:	W15X70A	WIDE FLANGE	15X70A
SECTION CODE:	W16X39	WIDE FLANGE	16X39	SECTION CODE:	W15X70B	WIDE FLANGE	15X70B
SECTION CODE:	W16X38	WIDE FLANGE	16X38	SECTION CODE:	W15X70C	WIDE FLANGE	15X70C
SECTION CODE:	W16X37	WIDE FLANGE	16X37	SECTION CODE:	W15X70D	WIDE FLANGE	15X70D
SECTION CODE:	WN16X36	WIDE FLANGE	16X36	SECTION CODE:	W15X69A	WIDE FLANGE	15X69A
SECTION CODE:	W16X35A	WIDE FLANGE	16X35A	SECTION CODE:	W15X69B	WIDE FLANGE	15X69B
SECTION CODE:	W16X35B	WIDE FLANGE	16X35B	SECTION CODE:	W15X69C	WIDE FLANGE	15X69C
SECTION CODE:	WN16X31	WIDE FLANGE	16X31	SECTION CODE:	W15X66A	WIDE FLANGE	15X66A
SECTION CODE:	WN16X26	WIDE FLANGE	16X26	SECTION CODE:	W15X66B	WIDE FLANGE	15X66B
SECTION CODE:	W15X147	WIDE FLANGE	15X147	SECTION CODE:	W15X65A	WIDE FLANGE	15X65A
SECTION CODE:	W15X141	WIDE FLANGE	15X141	SECTION CODE:	W15X65B	WIDE FLANGE	15X65B
SECTION CODE:	W15X140	WIDE FLANGE	15X140	SECTION CODE:	W15X65C	WIDE FLANGE	15X65C
SECTION CODE:	W15X135	WIDE FLANGE	15X135	SECTION CODE:	W15X65D	WIDE FLANGE	15X65D
SECTION CODE:	W15X127	WIDE FLANGE	15X127	SECTION CODE:	W15X64	WIDE FLANGE	15X64
SECTION CODE:	W15X111	WIDE FLANGE	15X111	SECTION CODE:	W15X60A	WIDE FLANGE	15X60A
SECTION CODE:	W15X108	WIDE FLANGE	15X108	SECTION CODE:	W15X60B	WIDE FLANGE	15X60B
SECTION CODE:	W15X105	WIDE FLANGE	15X105	SECTION CODE:	W15X60C	WIDE FLANGE	15X60C
SECTION CODE:	W15X104	WIDE FLANGE	15X104	SECTION CODE:	W15X60D	WIDE FLANGE	15X60D
SECTION CODE:	W15X100	WIDE FLANGE	15X100	SECTION CODE:	W15X60E	WIDE FLANGE	15X60E
SECTION CODE:	W15X99A	WIDE FLANGE	15X99A	SECTION CODE:	W15X59A	WIDE FLANGE	15X59A
SECTION CODE:	W15X99B	WIDE FLANGE	15X99B	SECTION CODE:	W15X59B	WIDE FLANGE	15X59B
SECTION CODE:	W15X95	WIDE FLANGE	159X5	SECTION CODE:	W15X57	WIDE FLANGE	15X57
SECTION CODE:	W15X94	WIDE FLANGE	15X94	SECTION CODE:	W15X56A	WIDE FLANGE	15X56A
SECTION CODE:	W15X91	WIDE FLANGE	15X91	SECTION CODE:	W15X56B	WIDE FLANGE	15X56B
SECTION CODE:	W15X90	WIDE FLANGE	15X90	SECTION CODE:	W15X55A	WIDE FLANGE	15X55A
SECTION CODE:	W15X85A	WIDE FLANGE	15X85A	SECTION CODE:	W15X55B	WIDE FLANGE	15X55B
SECTION CODE:	W15X85B	WIDE FLANGE	15X85B	SECTION CODE:	W15X55C	WIDE FLANGE	15X55C
SECTION CODE:	W15X85C	WIDE FLANGE	15X85C	SECTION CODE:	W15X55D	WIDE FLANGE	15X55D
SECTION CODE:	W15X81A	WIDE FLANGE	15X81A	SECTION CODE:	W15X54	WIDE FLANGE	15X54
SECTION CODE:	W15X81B	WIDE FLANGE	15X81B	SECTION CODE:	W15X52	WIDE FLANGE	15X52
SECTION CODE:	W15X80A	WIDE FLANGE	15X80A	SECTION CODE:	W15X51	WIDE FLANGE	15X51
SECTION CODE:	W15X80B	WIDE FLANGE	15X80B	SECTION CODE:	W15X50A	WIDE FLANGE	15X50A
SECTION CODE:	W15X80C	WIDE FLANGE	15X80C	SECTION CODE:	W15X50B	WIDE FLANGE	15X50B
SECTION CODE:	W15X75A	WIDE FLANGE	15X75A	SECTION CODE:	W15X50C	WIDE FLANGE	15X50C
SECTION CODE:	W15X75B	WIDE FLANGE	15X75B	SECTION CODE:	W15X49A	WIDE FLANGE	15X49A
SECTION CODE:	W15X75C	WIDE FLANGE	15X75C	SECTION CODE:	W15X49B	WIDE FLANGE	15X49B
SECTION CODE:	W15X75D	WIDE FLANGE	15X75D	SECTION CODE:	W15X48	WIDE FLANGE	15X48
SECTION CODE:	W15X74	WIDE FLANGE	15X74	SECTION CODE:	W15X47	WIDE FLANGE	15X47
SECTION CODE:	W15X73	WIDE FLANGE	15X73	SECTION CODE:	W15X46A	WIDE FLANGE	15X46A
SECTION CODE:	W15X72A	WIDE FLANGE	15X72A	SECTION CODE:	W15X46B	WIDE FLANGE	15X46B
SECTION CODE:	W15X72B	WIDE FLANGE	15X72B	SECTION CODE:	W15X45	WIDE FLANGE	15X45
SECTION CODE:	W15X72C	WIDE FLANGE	15X72C	SECTION CODE:	W15X44	WIDE FLANGE	15X44

SECTION CODE:	W15X43	WIDE FLANGE	15X43	SECTION CODE:	W14X202	WIDE FLANGE	14X202
SECTION CODE:	W15X42A	WIDE FLANGE	15X42A	SECTION CODE:	WN14X193	WIDE FLANGE	14X193
SECTION CODE:	W15X42B	WIDE FLANGE	15X42B	SECTION CODE:	W14X184	WIDE FLANGE	14X184
SECTION CODE:	W15X42C	WIDE FLANGE	15X42C	SECTION CODE:	WN14X176	WIDE FLANGE	14X176
SECTION CODE:	W15X42D	WIDE FLANGE	15X42D	SECTION CODE:	W14X167	WIDE FLANGE	14X167
SECTION CODE:	W15X41A	WIDE FLANGE	15X41A	SECTION CODE:	WN14X159	WIDE FLANGE	14X159
SECTION CODE:	W15X41B	WIDE FLANGE	15X41B	SECTION CODE:	W14X158	WIDE FLANGE	14X158
SECTION CODE:	W15X41C	WIDE FLANGE	15X41C	SECTION CODE:	W14X150	WIDE FLANGE	14X150
SECTION CODE:	W15X40	WIDE FLANGE	15X40	SECTION CODE:	WN14X145	WIDE FLANGE	14X145
SECTION CODE:	W15X39A	WIDE FLANGE	15X39A	SECTION CODE:	W14X142	WIDE FLANGE	14X142
SECTION CODE:	W15X39B	WIDE FLANGE	15X39B	SECTION CODE:	W14X136	WIDE FLANGE	14X136
SECTION CODE:	W15X38	WIDE FLANGE	15X38	SECTION CODE:	W14X135	WIDE FLANGE	14X135
SECTION CODE:	W15X37A	WIDE FLANGE	15X37A	SECTION CODE:	WN14X132	WIDE FLANGE	14X132
SECTION CODE:	W15X37B	WIDE FLANGE	15X37B	SECTION CODE:	W14X127	WIDE FLANGE	14X127
SECTION CODE:	W15X36A	WIDE FLANGE	15X36A	SECTION CODE:	W14X125	WIDE FLANGE	14X125
SECTION CODE:	W15X36B	WIDE FLANGE	15X36B	SECTION CODE:	WN14X120	WIDE FLANGE	14X120
SECTION CODE:	W15X36C	WIDE FLANGE	15X36C	SECTION CODE:	W14X119	WIDE FLANGE	14X119
SECTION CODE:	W15X35A	WIDE FLANGE	15X35A	SECTION CODE:	HN14X117	WIDE FLANGE	14X117
SECTION CODE:	W15X35B	WIDE FLANGE	15X35B	SECTION CODE:	W14X115	WIDE FLANGE	14X115
SECTION CODE:	W15X33	WIDE FLANGE	15X33	SECTION CODE:	W14X111	WIDE FLANGE	14X111
SECTION CODE:	WN14X730	WIDE FLANGE	14X730	SECTION CODE:	WN14X109	WIDE FLANGE	14X109
SECTION CODE:	WN14X665	WIDE FLANGE	14X665	SECTION CODE:	W14X106	WIDE FLANGE	14X106
SECTION CODE:	WN14X605	WIDE FLANGE	14X605	SECTION CODE:	W14X105	WIDE FLANGE	14X105
SECTION CODE:	WN14X550	WIDE FLANGE	14X550	SECTION CODE:	W14X103	WIDE FLANGE	14X103
SECTION CODE:	WN14X500	WIDE FLANGE	14X500	SECTION CODE:	HN14X102	WIDE FLANGE	14X102
SECTION CODE:	WN14X455	WIDE FLANGE	14X455	SECTION CODE:	WN14X99	WIDE FLANGE	14X99
SECTION CODE:	WN14X426	WIDE FLANGE	14X426	SECTION CODE:	W14X96	WIDE FLANGE	14X96
SECTION CODE:	WN14X398	WIDE FLANGE	14X398	SECTION CODE:	W14X95A	WIDE FLANGE	14X95A
SECTION CODE:	WN14X370	WIDE FLANGE	14X370	SECTION CODE:	W14X95B	WIDE FLANGE	14X95B
SECTION CODE:	WN14X342	WIDE FLANGE	14X342	SECTION CODE:	WN14X90	WIDE FLANGE	14X90
SECTION CODE:	W14X320	WIDE FLANGE	14X320	SECTION CODE:	HN14X89	WIDE FLANGE	14X89
SECTION CODE:	W14X314	WIDE FLANGE	14X314	SECTION CODE:	W14X87	WIDE FLANGE	14X87
SECTION CODE:	WN14X311	WIDE FLANGE	14X311	SECTION CODE:	W14X86	WIDE FLANGE	14X86
SECTION CODE:	W14X287	WIDE FLANGE	14X287	SECTION CODE:	W14X85	WIDE FLANGE	14X85
SECTION CODE:	WN14X283	WIDE FLANGE	14X283	SECTION CODE:	W14X84	WIDE FLANGE	14X84
SECTION CODE:	W14X264	WIDE FLANGE	14X264	SECTION CODE:	WN14X82	WIDE FLANGE	14X82
SECTION CODE:	WN14X257	WIDE FLANGE	14X257	SECTION CODE:	W14X78	WIDE FLANGE	14X78
SECTION CODE:	W14X246	WIDE FLANGE	14X246	SECTION CODE:	W14X75	WIDE FLANGE	14X75
SECTION CODE:	W14X237	WIDE FLANGE	14X237	SECTION CODE:	WN14X74	WIDE FLANGE	14X74
SECTION CODE:	WN14X233	WIDE FLANGE	14X233	SECTION CODE:	HN14X73	WIDE FLANGE	14X73
SECTION CODE:	W14X228	WIDE FLANGE	14X228	SECTION CODE:	W14X68	WIDE FLANGE	14X68
SECTION CODE:	W14X219	WIDE FLANGE	14X219	SECTION CODE:	WN14X68	WIDE FLANGE	14X68
SECTION CODE:	WN14X211	WIDE FLANGE	14X211	SECTION CODE:	W14X61	WIDE FLANGE	14X61

SECTION CODE:	WN14X61	WIDE FLANGE	14X61	SECTION CODE:	W12X92	WIDE FLANGE	12X92
SECTION CODE:	W14X58A	WIDE FLANGE	14X58A	SECTION CODE:	WN12X87	WIDE FLANGE	12X87
SECTION CODE:	W14X58B	WIDE FLANGE	14X58B	SECTION CODE:	W12X85	WIDE FLANGE	12X85
SECTION CODE:	W14X53	WIDE FLANGE	14X53	SECTION CODE:	HN12X84	WIDE FLANGE	12X84
SECTION CODE:	WN14X53	WIDE FLANGE	14X53	SECTION CODE:	W12X83	WIDE FLANGE	12X83
SECTION CODE:	W14X48	WIDE FLANGE	14X48	SECTION CODE:	W12X82	WIDE FLANGE	12X82
SECTION CODE:	WN14X48	WIDE FLANGE	14X48	SECTION CODE:	WN12X79	WIDE FLANGE	12X79
SECTION CODE:	WN14X43	WIDE FLANGE	14X43	SECTION CODE:	W12X77	WIDE FLANGE	12X77
SECTION CODE:	W14X42A	WIDE FLANGE	14X42A	SECTION CODE:	W12X76	WIDE FLANGE	12X76
SECTION CODE:	W14X42B	WIDE FLANGE	14X42B	SECTION CODE:	W12X75	WIDE FLANGE	12X75
SECTION CODE:	W14X39	WIDE FLANGE	14X39	SECTION CODE:	HN12X74	WIDE FLANGE	12X74
SECTION CODE:	WN14X38	WIDE FLANGE	14X38	SECTION CODE:	WN12X72	WIDE FLANGE	12X72
SECTION CODE:	W14X38A	WIDE FLANGE	14X38A	SECTION CODE:	W12X71	WIDE FLANGE	12X71
SECTION CODE:	W14X38B	WIDE FLANGE	14X38B	SECTION CODE:	W12X70A	WIDE FLANGE	12X70A
SECTION CODE:	W14X37	WIDE FLANGE	14X37	SECTION CODE:	W12X70B	WIDE FLANGE	12X70B
SECTION CODE:	W14X36	WIDE FLANGE	14X36	SECTION CODE:	W12X66A	WIDE FLANGE	12X66A
SECTION CODE:	WN14X34	WIDE FLANGE	14X34	SECTION CODE:	W12X66B	WIDE FLANGE	12X66B
SECTION CODE:	W14X33	WIDE FLANGE	14X33	SECTION CODE:	W12X66C	WIDE FLANGE	12X66C
SECTION CODE:	W14X32	WIDE FLANGE	14X32	SECTION CODE:	WN12X65	WIDE FLANGE	12X65
SECTION CODE:	W14X30	WIDE FLANGE	14X30	SECTION CODE:	W12X65A	WIDE FLANGE	12X65A
SECTION CODE:	WN14X30	WIDE FLANGE	14X30	SECTION CODE:	W12X65B	WIDE FLANGE	12X65B
SECTION CODE:	WN14X26	WIDE FLANGE	14X26	SECTION CODE:	W12X65C	WIDE FLANGE	12X65C
SECTION CODE:	WN14X22	WIDE FLANGE	14X22	SECTION CODE:	W12X64	WIDE FLANGE	12X64
SECTION CODE:	HN13X100	WIDE FLANGE	13X100	SECTION CODE:	HN12X63	WIDE FLANGE	12X63
SECTION CODE:	HN13X87	WIDE FLANGE	13X87	SECTION CODE:	W12X61	WIDE FLANGE	12X61
SECTION CODE:	HN13X73	WIDE FLANGE	13X73	SECTION CODE:	W12X60A	WIDE FLANGE	12X60A
SECTION CODE:	HN13X60	WIDE FLANGE	13X60	SECTION CODE:	W12X60B	WIDE FLANGE	12X60B
SECTION CODE:	WN12X336	WIDE FLANGE	12X336	SECTION CODE:	W12X60C	WIDE FLANGE	12X60C
SECTION CODE:	WN12X305	WIDE FLANGE	12X305	SECTION CODE:	W12X60D	WIDE FLANGE	12X60D
SECTION CODE:	WN12X279	WIDE FLANGE	12X279	SECTION CODE:	W12X60E	WIDE FLANGE	12X60E
SECTION CODE:	WN12X252	WIDE FLANGE	12X252	SECTION CODE:	W12X60F	WIDE FLANGE	12X60F
SECTION CODE:	WN12X230	WIDE FLANGE	12X230	SECTION CODE:	WN12X58	WIDE FLANGE	12X58
SECTION CODE:	WN12X210	WIDE FLANGE	12X210	SECTION CODE:	W12X56A	WIDE FLANGE	12X56A
SECTION CODE:	WN12X190	WIDE FLANGE	12X190	SECTION CODE:	W12X56B	WIDE FLANGE	12X56B
SECTION CODE:	WN12X170	WIDE FLANGE	12X170	SECTION CODE:	W12X55A	WIDE FLANGE	12X55A
SECTION CODE:	W12X161	WIDE FLANGE	12X161	SECTION CODE:	W12X55B	WIDE FLANGE	12X55B
SECTION CODE:	WN12X152	WIDE FLANGE	12X152	SECTION CODE:	W12X55C	WIDE FLANGE	12X55C
SECTION CODE:	WN12X136	WIDE FLANGE	12X136	SECTION CODE:	W12X55D	WIDE FLANGE	12X55D
SECTION CODE:	W12X133	WIDE FLANGE	12X133	SECTION CODE:	W12X55E	WIDE FLANGE	12X55E
SECTION CODE:	WN12X120	WIDE FLANGE	12X120	SECTION CODE:	W12X55F	WIDE FLANGE	12X55F
SECTION CODE:	WN12X106	WIDE FLANGE	12X106	SECTION CODE:	WN12X53	WIDE FLANGE	12X53
SECTION CODE:	W12X99	WIDE FLANGE	12X99	SECTION CODE:	HN12X53	WIDE FLANGE	12X53
SECTION CODE:	WN12X96	WIDE FLANGE	12X96	SECTION CODE:	W12X52	WIDE FLANGE	12X52

SECTION CODE:	WN12X50	WIDE FLANGE	12X50	SECTION CODE:	W12X31E	WIDE FLANGE	12X31E
SECTION CODE:	W12X50A	WIDE FLANGE	12X50A	SECTION CODE:	W12X31F	WIDE FLANGE	12X31F
SECTION CODE:	W12X50B	WIDE FLANGE	12X50B	SECTION CODE:	W12X30A	WIDE FLANGE	12X30A
SECTION CODE:	W12X50C	WIDE FLANGE	12X50C	SECTION CODE:	W12X30B	WIDE FLANGE	12X30B
SECTION CODE:	W12X49	WIDE FLANGE	12X49	SECTION CODE:	WN12X30	WIDE FLANGE	12X30
SECTION CODE:	W12X48	WIDE FLANGE	12X48	SECTION CODE:	W12X30C	WIDE FLANGE	12X30C
SECTION CODE:	W12X47	WIDE FLANGE	12X47	SECTION CODE:	W12X29	WIDE FLANGE	12X29
SECTION CODE:	WN12X45	WIDE FLANGE	12X45	SECTION CODE:	W12X28A	WIDE FLANGE	12X28A
SECTION CODE:	W12X45A	WIDE FLANGE	12X45A	SECTION CODE:	W12X28B	WIDE FLANGE	12X28B
SECTION CODE:	W12X45B	WIDE FLANGE	12X45B	SECTION CODE:	W12X28C	WIDE FLANGE	12X28C
SECTION CODE:	W12X44A	WIDE FLANGE	12X44A	SECTION CODE:	W12X28X	W12 taken from AISC 1940	
SECTION CODE:	W12X44B	WIDE FLANGE	12X44B	SECTION CODE:	W12X27A	WIDE FLANGE	12X27A
SECTION CODE:	W12X44C	WIDE FLANGE	12X44C	SECTION CODE:	W12X27B	WIDE FLANGE	12X27B
SECTION CODE:	W12X40A	WIDE FLANGE	12X40A	SECTION CODE:	W12X27C	WIDE FLANGE	12X27C
SECTION CODE:	WN12X40	WIDE FLANGE	12X40	SECTION CODE:	WN12X26	WIDE FLANGE	12X26
SECTION CODE:	W12X40B	WIDE FLANGE	12X40B	SECTION CODE:	W12X25A	WIDE FLANGE	12X25A
SECTION CODE:	W12X40C	WIDE FLANGE	12X40C	SECTION CODE:	W12X25B	WIDE FLANGE	12X25B
SECTION CODE:	W12X40D	WIDE FLANGE	12X40D	SECTION CODE:	W12X25C	WIDE FLANGE	12X25C
SECTION CODE:	W12X40E	WIDE FLANGE	12X40E	SECTION CODE:	W12X25D	WIDE FLANGE	12X25D
SECTION CODE:	W12X40F	WIDE FLANGE	12X40F	SECTION CODE:	WN12X22	WIDE FLANGE	12X22
SECTION CODE:	W12X39A	WIDE FLANGE	12X39A	SECTION CODE:	WN12X19	WIDE FLANGE	12X19
SECTION CODE:	W12X39B	WIDE FLANGE	12X39B	SECTION CODE:	W12X16	WIDE FLANGE	12X16
SECTION CODE:	W12X39C	WIDE FLANGE	12X39C	SECTION CODE:	WN12X16	WIDE FLANGE	12X16
SECTION CODE:	W12X38A	WIDE FLANGE	12X38A	SECTION CODE:	WN12X14	WIDE FLANGE	12X14
SECTION CODE:	W12X38B	WIDE FLANGE	12X38B	SECTION CODE:	WN10X112	WIDE FLANGE	10X112
SECTION CODE:	W12X37	WIDE FLANGE	12X37	SECTION CODE:	WN10X100	WIDE FLANGE	10X100
SECTION CODE:	W12X36A	WIDE FLANGE	12X36A	SECTION CODE:	W10X89	WIDE FLANGE	12X89
SECTION CODE:	W12X36B	WIDE FLANGE	12X36B	SECTION CODE:	WN10X88	WIDE FLANGE	10X88
SECTION CODE:	W12X36C	WIDE FLANGE	12X36C	SECTION CODE:	WN10X77	WIDE FLANGE	10X77
SECTION CODE:	W12X36D	WIDE FLANGE	12X36D	SECTION CODE:	W10X72	WIDE FLANGE	10X72
SECTION CODE:	WN12X35	WIDE FLANGE	12X35	SECTION CODE:	WN10X68	WIDE FLANGE	10X68
SECTION CODE:	W12X35A	WIDE FLANGE	12X35A	SECTION CODE:	W10X66	WIDE FLANGE	10X66
SECTION CODE:	W12X35B	WIDE FLANGE	12X35B	SECTION CODE:	W10X64	WIDE FLANGE	10X64
SECTION CODE:	W12X34A	WIDE FLANGE	12X34A	SECTION CODE:	W10X63	WIDE FLANGE	10X63
SECTION CODE:	W12X34B	WIDE FLANGE	12X34B	SECTION CODE:	WN10X60	WIDE FLANGE	10X60
SECTION CODE:	W12X33	WIDE FLANGE	12X33	SECTION CODE:	W10X59	WIDE FLANGE	10X59
SECTION CODE:	W12X32A	WIDE FLANGE	12X32A	SECTION CODE:	HN10X57	WIDE FLANGE	10X57
SECTION CODE:	W12X32B	WIDE FLANGE	12X32B	SECTION CODE:	W10X56	WIDE FLANGE	10X56
SECTION CODE:	W12X32C	WIDE FLANGE	12X32C	SECTION CODE:	WN10X54	WIDE FLANGE	10X54
SECTION CODE:	W12X31A	WIDE FLANGE	12X31A	SECTION CODE:	W10X54	WIDE FLANGE	10X54
SECTION CODE:	W12X31B	WIDE FLANGE	12X31B	SECTION CODE:	W10X50	WIDE FLANGE	10X50
SECTION CODE:	W12X31C	WIDE FLANGE	12X31C	SECTION CODE:	WN10X49	WIDE FLANGE	10X49
SECTION CODE:	W12X31D	WIDE FLANGE	12X31D	SECTION CODE:	W10X49	WIDE FLANGE	10X49

SECTION CODE:	W10X45A	WIDE FLANGE	10X45A	SECTION CODE:	W10X25F	WIDE FLANGE	10X25F
SECTION CODE:	WN10X45	WIDE FLANGE	10X45	SECTION CODE:	W10X24	WIDE FLANGE	10X24
SECTION CODE:	W10X45B	WIDE FLANGE	10X45B	SECTION CODE:	W10X23A	WIDE FLANGE	10X23A
SECTION CODE:	W10X44	WIDE FLANGE	10X44	SECTION CODE:	W10X23B	WIDE FLANGE	10X23B
SECTION CODE:	W10X43	WIDE FLANGE	10X43	SECTION CODE:	W10X23C	WIDE FLANGE	10X23C
SECTION CODE:	W10X42A	WIDE FLANGE	10X42A	SECTION CODE:	W10X23D	WIDE FLANGE	10X23D
SECTION CODE:	HN10X42	WIDE FLANGE	10X42	SECTION CODE:	W10X23E	WIDE FLANGE	10X23E
SECTION CODE:	W10X42B	WIDE FLANGE	10X42B	SECTION CODE:	W10X22A	WIDE FLANGE	10X22A
SECTION CODE:	W10X41	WIDE FLANGE	10X41	SECTION CODE:	W10X22B	WIDE FLANGE	10X22B
SECTION CODE:	W10X40A	WIDE FLANGE	10X40A	SECTION CODE:	WN10X22	WIDE FLANGE	10X22
SECTION CODE:	W10X40B	WIDE FLANGE	10X40B	SECTION CODE:	W10X22C	WIDE FLANGE	10X22C
SECTION CODE:	WN10X39	WIDE FLANGE	10X39	SECTION CODE:	W10X22D	WIDE FLANGE	10X22D
SECTION CODE:	W10X37	WIDE FLANGE	10X37	SECTION CODE:	W10X22E	WIDE FLANGE	10X22E
SECTION CODE:	W10X36	WIDE FLANGE	10X36	SECTION CODE:	W10X21A	WIDE FLANGE	10X21A
SECTION CODE:	W10X35A	WIDE FLANGE	10X35A	SECTION CODE:	W10X21B	WIDE FLANGE	10X21B
SECTION CODE:	W10X35B	WIDE FLANGE	10X35B	SECTION CODE:	W10X21C	WIDE FLANGE	10X21C
SECTION CODE:	W10X34	WIDE FLANGE	10X34	SECTION CODE:	WN10X19	WIDE FLANGE	10X19
SECTION CODE:	WN10X33	WIDE FLANGE	10X33	SECTION CODE:	WN10X17	WIDE FLANGE	10X17
SECTION CODE:	W10X33	WIDE FLANGE	10X33	SECTION CODE:	WN10X15	WIDE FLANGE	10X15
SECTION CODE:	W10X32A	WIDE FLANGE	10X32A	SECTION CODE:	WN10X12	WIDE FLANGE	10X12
SECTION CODE:	W10X32B	WIDE FLANGE	10X32B	SECTION CODE:	W10X11	WIDE FLANGE	10X11
SECTION CODE:	W10X31A	WIDE FLANGE	10X31A	SECTION CODE:	W9X48	WIDE FLANGE	9X48
SECTION CODE:	W10X31B	WIDE FLANGE	10X31B	SECTION CODE:	W9X44	WIDE FLANGE	9X44
SECTION CODE:	W10X30A	WIDE FLANGE	10X30A	SECTION CODE:	W9X43	WIDE FLANGE	9X43
SECTION CODE:	W10X30B	WIDE FLANGE	10X30B	SECTION CODE:	W9X38	WIDE FLANGE	9X38
SECTION CODE:	WN10X30	WIDE FLANGE	10X30	SECTION CODE:	W9X36	WIDE FLANGE	9X36
SECTION CODE:	W10X30C	WIDE FLANGE	10X30C	SECTION CODE:	W9X35A	WIDE FLANGE	9X35A
SECTION CODE:	W10X30D	WIDE FLANGE	10X30D	SECTION CODE:	W9X35B	WIDE FLANGE	9X35B
SECTION CODE:	W10X29A	WIDE FLANGE	10x29A	SECTION CODE:	W9X35C	WIDE FLANGE	9X35C
SECTION CODE:	W10X29B	WIDE FLANGE	10X29B	SECTION CODE:	W9X33	WIDE FLANGE	9X33
SECTION CODE:	W10X29C	WIDE FLANGE	10X29C	SECTION CODE:	W9X32	WIDE FLANGE	9X32
SECTION CODE:	W10X29D	WIDE FLANGE	10X29D	SECTION CODE:	W9X30A	WIDE FLANGE	9X30A
SECTION CODE:	W10X28A	WIDE FLANGE	10X28A	SECTION CODE:	W9X30B	WIDE FLANGE	9X30B
SECTION CODE:	W10X28B	WIDE FLANGE	10X28B	SECTION CODE:	W9X29	WIDE FLANGE	9X29
SECTION CODE:	W10X27	WIDE FLANGE	10X27	SECTION CODE:	W9X28A	WIDE FLANGE	9X28A
SECTION CODE:	WN10X26	WIDE FLANGE	10X26	SECTION CODE:	W9X28B	WIDE FLANGE	9X28B
SECTION CODE:	W10X26A	WIDE FLANGE	10X26A	SECTION CODE:	W9X27	WIDE FLANGE	9X27
SECTION CODE:	W10X26B	WIDE FLANGE	10X26B	SECTION CODE:	W9X26	WIDE FLANGE	9X26
SECTION CODE:	W10X25A	WIDE FLANGE	10X25A	SECTION CODE:	W9X25A	WIDE FLANGE	9X25A
SECTION CODE:	W10X25B	WIDE FLANGE	10X25B	SECTION CODE:	W9X25B	WIDE FLANGE	9X25B
SECTION CODE:	W10X25C	WIDE FLANGE	10X25C	SECTION CODE:	W9X25C	WIDE FLANGE	9X25C
SECTION CODE:	W10X25D	WIDE FLANGE	10X25D	SECTION CODE:	W9X24A	WIDE FLANGE	9X24A
SECTION CODE:	W10X25E	WIDE FLANGE	10X25E	SECTION CODE:	W9X24B	WIDE FLANGE	9X24B

SECTION CODE:	W9X24C	WIDE FLANGE	9X24C	SECTION CODE:	WN8X24	WIDE FLANGE	8X24
SECTION CODE:	W9X23A	WIDE FLANGE	9X23A	SECTION CODE:	W8X24B	WIDE FLANGE	8X24B
SECTION CODE:	W9X23B	WIDE FLANGE	9X23B	SECTION CODE:	W8X23A	WIDE FLANGE	8X23A
SECTION CODE:	W9X23C	WIDE FLANGE	9X23C	SECTION CODE:	W8X23B	WIDE FLANGE	8X23B
SECTION CODE:	W9X22	WIDE FLANGE	9X22	SECTION CODE:	W8X22A	WIDE FLANGE	8X22A
SECTION CODE:	W9X21A	WIDE FLANGE	9X21A	SECTION CODE:	W8X22B	WIDE FLANGE	8X22B
SECTION CODE:	W9X21B	WIDE FLANGE	9X21B	SECTION CODE:	W8X22C	WIDE FLANGE	8X22C
SECTION CODE:	W9X21C	WIDE FLANGE	9X21C	SECTION CODE:	W8X21A	WIDE FLANGE	8X21A
SECTION CODE:	W9X21D	WIDE FLANGE	9X21D	SECTION CODE:	W8X21B	WIDE FLANGE	8X21B
SECTION CODE:	W9X21E	WIDE FLANGE	9X21E	SECTION CODE:	WN8X21	WIDE FLANGE	8X21
SECTION CODE:	W9X21F	WIDE FLANGE	9X21F	SECTION CODE:	W8X21C	WIDE FLANGE	8X21C
SECTION CODE:	W9X20A	WIDE FLANGE	9X20A	SECTION CODE:	W8X21D	WIDE FLANGE	8X21D
SECTION CODE:	W9X20B	WIDE FLANGE	9X20B	SECTION CODE:	W8X21E	WIDE FLANGE	8X21E
SECTION CODE:	W9X20C	WIDE FLANGE	9X20C	SECTION CODE:	W8X20A	WIDE FLANGE	8X20A
SECTION CODE:	W9X20D	WIDE FLANGE	9X20D	SECTION CODE:	W8X20B	WIDE FLANGE	8X20B
SECTION CODE:	W9X19A	WIDE FLANGE	9X19A	SECTION CODE:	W8X20C	WIDE FLANGE	8X20C
SECTION CODE:	W9X19B	WIDE FLANGE	9X19B	SECTION CODE:	W8X20D	WIDE FLANGE	8X20D
SECTION CODE:	WN8X67	WIDE FLANGE	8X67	SECTION CODE:	W8X20E	WIDE FLANGE	8X20E
SECTION CODE:	WN8X58	WIDE FLANGE	8X58	SECTION CODE:	W8X19A	WIDE FLANGE	8X19A
SECTION CODE:	WN8X48	WIDE FLANGE	8X48	SECTION CODE:	W8X19B	WIDE FLANGE	8X19B
SECTION CODE:	WN8X40	WIDE FLANGE	8X40	SECTION CODE:	W8X18A	WIDE FLANGE	8X18A
SECTION CODE:	W8X37	WIDE FLANGE	8X37	SECTION CODE:	WN8X18	WIDE FLANGE	8X18
SECTION CODE:	W8X36	WIDE FLANGE	8X36	SECTION CODE:	W8X18B	WIDE FLANGE	8X18B
SECTION CODE:	HN8X36	WIDE FLANGE	8X36	SECTION CODE:	W8X18C	WIDE FLANGE	8X18C
SECTION CODE:	WN8X35	WIDE FLANGE	8X35	SECTION CODE:	W8X18D	WIDE FLANGE	8X18D
SECTION CODE:	W8X33	WIDE FLANGE	8X33	SECTION CODE:	W8X18E	WIDE FLANGE	8X18E
SECTION CODE:	W8X32A	WIDE FLANGE	8X32A	SECTION CODE:	W8X17A	WIDE FLANGE	8X17A
SECTION CODE:	W8X32B	WIDE FLANGE	8X32B	SECTION CODE:	W8X17B	WIDE FLANGE	8X17B
SECTION CODE:	WN8X31	WIDE FLANGE	8X31	SECTION CODE:	W8X17C	WIDE FLANGE	8X17C
SECTION CODE:	W8X30A	WIDE FLANGE	8X30A	SECTION CODE:	W8X17D	WIDE FLANGE	8X17D
SECTION CODE:	W8X30B	WIDE FLANGE	8X30B	SECTION CODE:	W8X17E	WIDE FLANGE	8X17E
SECTION CODE:	W8X29	WIDE FLANGE	8X29	SECTION CODE:	W8X17F	WIDE FLANGE	8X17F
SECTION CODE:	W8X28	WIDE FLANGE	8X28	SECTION CODE:	W8X17G	WIDE FLANGE	8X17G
SECTION CODE:	WN8X28	WIDE FLANGE	8X28	SECTION CODE:	W8X17H	WIDE FLANGE	8X17H
SECTION CODE:	W8X27A	WIDE FLANGE	8X27A	SECTION CODE:	W8X16	WIDE FLANGE	8X16
SECTION CODE:	W8X27B	WIDE FLANGE	8X27B	SECTION CODE:	WN8X15	WIDE FLANGE	8X15
SECTION CODE:	W8X26	WIDE FLANGE	8X26	SECTION CODE:	WN8X13	WIDE FLANGE	8X13
SECTION CODE:	W8X25A	WIDE FLANGE	8X25A	SECTION CODE:	WN8X10	WIDE FLANGE	8X10
SECTION CODE:	W8X25B	WIDE FLANGE	8X25B	SECTION CODE:	W7X26	WIDE FLANGE	7X26
SECTION CODE:	W8X25C	WIDE FLANGE	8X25C	SECTION CODE:	W7X25	WIDE FLANGE	7X25
SECTION CODE:	W8X25D	WIDE FLANGE	8X25D	SECTION CODE:	W7X22A	WIDE FLANGE	7X22A
SECTION CODE:	W8X25E	WIDE FLANGE	8X25E	SECTION CODE:	W7X22B	WIDE FLANGE	7X22B
SECTION CODE:	W8X24A	WIDE FLANGE	8X24A	SECTION CODE:	W7X21	WIDE FLANGE	7X21

SECTION CODE:	W7X20A	WIDE FLANGE	7X20A	SECTION CODE:	W6X16B	WIDE FLANGE	6X16B
SECTION CODE:	W7X20B	WIDE FLANGE	7X20B	SECTION CODE:	W6X16C	WIDE FLANGE	6X16C
SECTION CODE:	W7X20C	WIDE FLANGE	7X20C	SECTION CODE:	WN6X16	WIDE FLANGE	6X16
SECTION CODE:	W7X20D	WIDE FLANGE	7X20D	SECTION CODE:	W6X16D	WIDE FLANGE	6X16D
SECTION CODE:	W7X20E	WIDE FLANGE	7X20E	SECTION CODE:	W6X15A	WIDE FLANGE	6X15A
SECTION CODE:	W7X19	WIDE FLANGE	7X19	SECTION CODE:	W6X15B	WIDE FLANGE	6X15B
SECTION CODE:	W7X18A	WIDE FLANGE	7X18A	SECTION CODE:	W6X15C	WIDE FLANGE	6X15C
SECTION CODE:	W7X18B	WIDE FLANGE	7X18B	SECTION CODE:	W6X15D	WIDE FLANGE	6X15D
SECTION CODE:	W7X17A	WIDE FLANGE	7X17A	SECTION CODE:	WN6X15	WIDE FLANGE	6X15
SECTION CODE:	W7X17B	WIDE FLANGE	7X17B	SECTION CODE:	W6X15E	WIDE FLANGE	6X15E
SECTION CODE:	W7X17C	WIDE FLANGE	7X17C	SECTION CODE:	W6X14	WIDE FLANGE	6X14
SECTION CODE:	W7X15A	WIDE FLANGE	7X15A	SECTION CODE:	W6X13A	WIDE FLANGE	6X13A
SECTION CODE:	W7X15B	WIDE FLANGE	7X15B	SECTION CODE:	W6X13B	WIDE FLANGE	6X13B
SECTION CODE:	W7X15C	WIDE FLANGE	7X15C	SECTION CODE:	W6X12A	WIDE FLANGE	6X12A
SECTION CODE:	W7X15D	WIDE FLANGE	7X15D	SECTION CODE:	W6X12B	WIDE FLANGE	6X12B
SECTION CODE:	W7X15E	WIDE FLANGE	7X15E	SECTION CODE:	W6X12C	WIDE FLANGE	6X12C
SECTION CODE:	W7X14	WIDE FLANGE	7X14	SECTION CODE:	WN6X12	WIDE FLANGE	6X12
SECTION CODE:	W6X46	WIDE FLANGE	6X46	SECTION CODE:	W6X12D	WIDE FLANGE	6X12D
SECTION CODE:	W6X41A	WIDE FLANGE	6X41A	SECTION CODE:	W6X11A	WIDE FLANGE	6X11A
SECTION CODE:	W6X41B	WIDE FLANGE	6X41B	SECTION CODE:	W6X11B	WIDE FLANGE	6X11B
SECTION CODE:	W6X37	WIDE FLANGE	6X37	SECTION CODE:	WN6X9	WIDE FLANGE	6X9
SECTION CODE:	W6X32	WIDE FLANGE	6X32	SECTION CODE:	W6X8	WIDE FLANGE	6X8
SECTION CODE:	W6X30	WIDE FLANGE	6X30	SECTION CODE:	WN5X19	WIDE FLANGE	5X19
SECTION CODE:	W6X27A	WIDE FLANGE	6X27A	SECTION CODE:	W5X18A	WIDE FLANGE	5X18A
SECTION CODE:	W6X27B	WIDE FLANGE	6X27B	SECTION CODE:	W5X18B	WIDE FLANGE	5X18B
SECTION CODE:	WN6X25	WIDE FLANGE	6X25	SECTION CODE:	W5X17	WIDE FLANGE	5X17
SECTION CODE:	W6X25	WIDE FLANGE	6X25	SECTION CODE:	WN5X16	WIDE FLANGE	5X16
SECTION CODE:	W6X23A	WIDE FLANGE	6X23A	SECTION CODE:	W5X16	WIDE FLANGE	5X16
SECTION CODE:	W6X23B	WIDE FLANGE	6X23B	SECTION CODE:	W5X15	WIDE FLANGE	5X15
SECTION CODE:	W6X22A	WIDE FLANGE	6X22A	SECTION CODE:	W5X14A	WIDE FLANGE	5X14A
SECTION CODE:	W6X22B	WIDE FLANGE	6X22B	SECTION CODE:	W5X14B	WIDE FLANGE	5X14B
SECTION CODE:	W6X21	WIDE FLANGE	6X21	SECTION CODE:	W5X13A	WIDE FLANGE	5X13A
SECTION CODE:	W6X20A	WIDE FLANGE	6X20A	SECTION CODE:	W5X13B	WIDE FLANGE	5X13B
SECTION CODE:	WN6X20	WIDE FLANGE	6X20	SECTION CODE:	W5X12A	WIDE FLANGE	5X12A
SECTION CODE:	W6X20B	WIDE FLANGE	6X20B	SECTION CODE:	W5X12B	WIDE FLANGE	5X12B
SECTION CODE:	W6X20C	WIDE FLANGE	6X20C	SECTION CODE:	W5X12C	WIDE FLANGE	5X12C
SECTION CODE:	W6X18A	WIDE FLANGE	6X18A	SECTION CODE:	W5X10	WIDE FLANGE	5X10
SECTION CODE:	W6X18B	WIDE FLANGE	6X18B	SECTION CODE:	W5X9A	WIDE FLANGE	5X9A
SECTION CODE:	W6X18C	WIDE FLANGE	6X18C	SECTION CODE:	W5X9B	WIDE FLANGE	5X9B
SECTION CODE:	W6X18D	WIDE FLANGE	6X18D	SECTION CODE:	W5X9C	WIDE FLANGE	5X9C
SECTION CODE:	W6X17A	WIDE FLANGE	6X17A	SECTION CODE:	W4X16	WIDE FLANGE	4X16
SECTION CODE:	W6X17B	WIDE FLANGE	6X17B	SECTION CODE:	W4X13A	WIDE FLANGE	4X13A
SECTION CODE:	W6X16A	WIDE FLANGE	6X16A	SECTION CODE:	WN4X13	WIDE FLANGE	4X13

SECTION CODE:	W4X13B	WIDE FLANGE	4X13B
SECTION CODE:	W4X13C	WIDE FLANGE	4X13C
SECTION CODE:	W4X11A	WIDE FLANGE	4X11A
SECTION CODE:	W4X11B	WIDE FLANGE	4X11B
SECTION CODE:	W4X10A	WIDE FLANGE	4X10A
SECTION CODE:	W4X10B	WIDE FLANGE	4X10B
SECTION CODE:	W4X10C	WIDE FLANGE	4X10C
SECTION CODE:	W4X10D	WIDE FLANGE	4X10D
SECTION CODE:	W4X9A	WIDE FLANGE	4X9A
SECTION CODE:	W4X9B	WIDE FLANGE	4X9B
SECTION CODE:	W4X8A	WIDE FLANGE	4X8A
SECTION CODE:	W4X8B	WIDE FLANGE	4X8B
SECTION CODE:	W4X7A	WIDE FLANGE	4X7A
SECTION CODE:	W4X7B	WIDE FLANGE	4X7B
SECTION CODE:	W4X7C	WIDE FLANGE	4X7C
SECTION CODE:	W4X7D	WIDE FLANGE	4X7D
SECTION CODE:	W4X6A	WIDE FLANGE	4X6A
SECTION CODE:	W4X6B	WIDE FLANGE	4X6B
SECTION CODE:	W3X9A	WIDE FLANGE	3X9A
SECTION CODE:	W3X9B	WIDE FLANGE	3X9B
SECTION CODE:	W3X7A	WIDE FLANGE	3X7A
SECTION CODE:	W3X7B	WIDE FLANGE	3X7B
SECTION CODE:	W3X6A	WIDE FLANGE	3X6A
SECTION CODE:	W3X6B	WIDE FLANGE	3X6B
SECTION CODE:	W3X6C	WIDE FLANGE	3X6C
SECTION CODE:	W3X6D	WIDE FLANGE	3X6D
SECTION CODE:	W3X6E	WIDE FLANGE	3X6E
SECTION CODE:	W3X5A	WIDE FLANGE	3X5A
SECTION CODE:	W3X5B	WIDE FLANGE	3X5B
SECTION CODE:	W3X5C	WIDE FLANGE	3X5C
SECTION CODE:	W3X5D	WIDE FLANGE	3X5D
SECTION CODE:	W3X5E	WIDE FLANGE	3X53
SECTION CODE:	AASHTO-I	AASHTO I-GIRDER 28 IN	
SECTION CODE:	AASHTO-IB	MOD AASHTO TYPE I MANUFACT IN CASPER	
SECTION CODE:	AASHTO-II	AASHTO I-GIRDER 36 IN	
SECTION CODE:	AASHTO-III	AASHTO I-GIRDER 45 IN	
SECTION CODE:	AASHTO-IV	AASHTO I-GIRDER 54 IN	
SECTION CODE:	AASHTO-V	AASHTO I-GIRDER 63 IN	
SECTION CODE:	AASHTO-VI	AASHTO GIRDER 72 IN	
SECTION CODE:	K3	KANSAS-K3	
SECTION CODE:	K4	KANSAS-K4	

SECTION CODE:	MONT-A	THIS SECTION IS MANUFACTURED BY BY UNITED PRESTRESS